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BENTON HARBOR MUNICIPAL PUMPING PLANT

TRIPLEX PUMP WITH DUPLEX AUXILIARIES

STEAM ENGINE HISTORY BEGINS with the pumping engine and from the time of those crude and inefficient pumps to the present date of economical steam power, a large percentage of the work done by steam engines has been that of pumping water for all kinds industrial and domestic purposes. Pumping engines have also played an initial part in the development of municipalities, for there is scarcely a village of more than 500 inhabitants that does not own and operate a pumping plant and water works system to supply the needs of the people.

The city of Benton Harbor, Mich., which now has about 10,000 inhabitants, has for years operated a pumping plant and has now grown to the extent that 21 6-in. wells are required to supply the needs of the community. These wells cover an area of several blocks and range in depth from 65 to 165 ft., the main suction pipe being about 1,000 ft. in length and placed about 8 ft. below the surface of the ground.

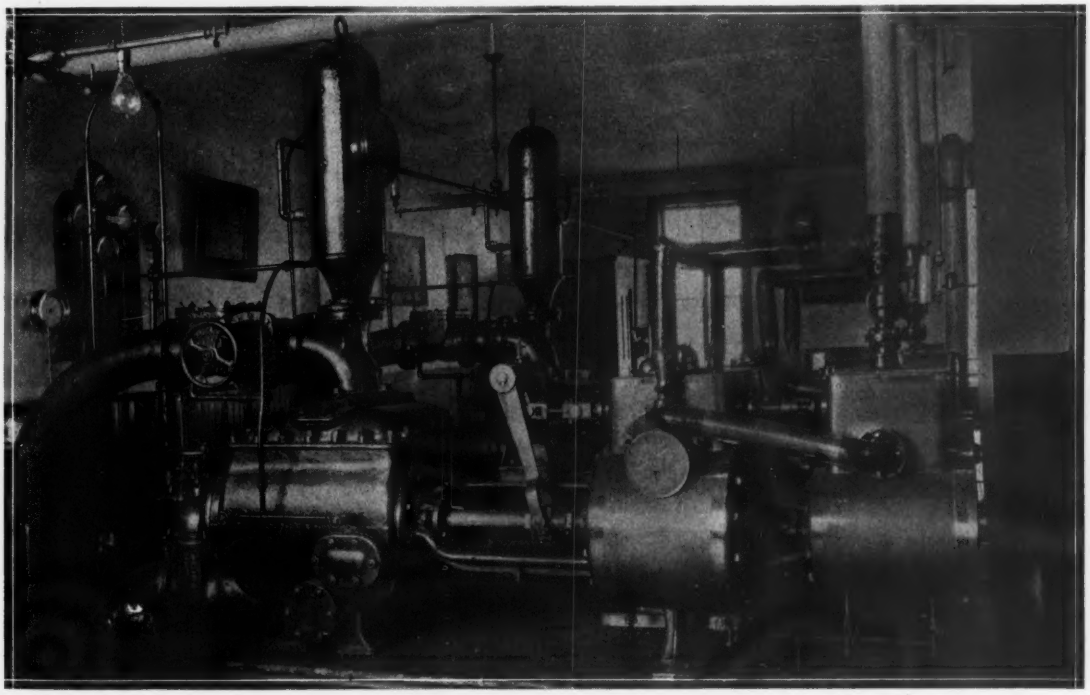


FIG. 6. COMPOUND DUPLEX PUMPING ENGINES IN BENTON HARBOR PLANT

Boiler Room

STEAM used in the pumping engines is generated in a battery of 2 boilers made by the Atlas Engine Works, and rated at 70 hp. each. They are of the return tubular type consisting of 48 4-in. fire tubes in a shell 60 in. in diameter and 14 ft. long. The flue gases are conducted by a common 36 in. breeching from the front of the boiler to the stack at the rear. The stack is built of brick upon a solid foundation and extends 80 ft. high, with an inside diameter of 36 in.

The boilers are equipped with Wright water col-

umns and carry a pressure of about 100 lb. Asbestos packed Crane blowoff valves are used to discharge

FIG. 1. BENTON HARBOR PUMPING PLANT

the sludge from the boilers and the blowoff pipes serve also as feed-water pipes. There is a 4 in. pop-safety valve on each boiler, also made by the Crane Co. Steam is conducted to the pumping engines through a 4-in. header, which is provided with valves,

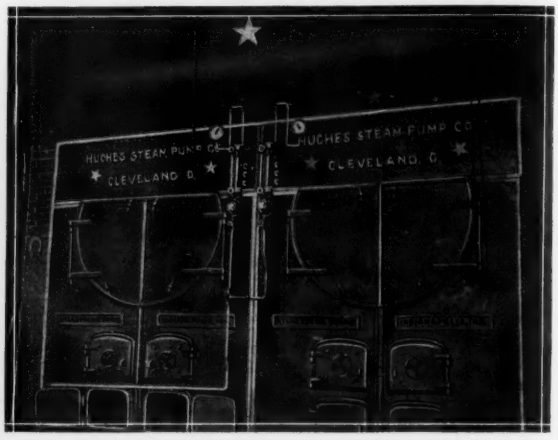


FIG. 2. BOILERS IN BENTON HARBOR PLANT

making it possible to use either or both boilers at any time. For giving alarm in case of fire, a mocking bird whistle is employed and is placed upon the roof directly over the boilers.

At the back of the boiler room is located the coal bunker, which has a capacity of 100 tons. From this storage room coal is carted to the boiler room and fired by hand upon common flat grates.

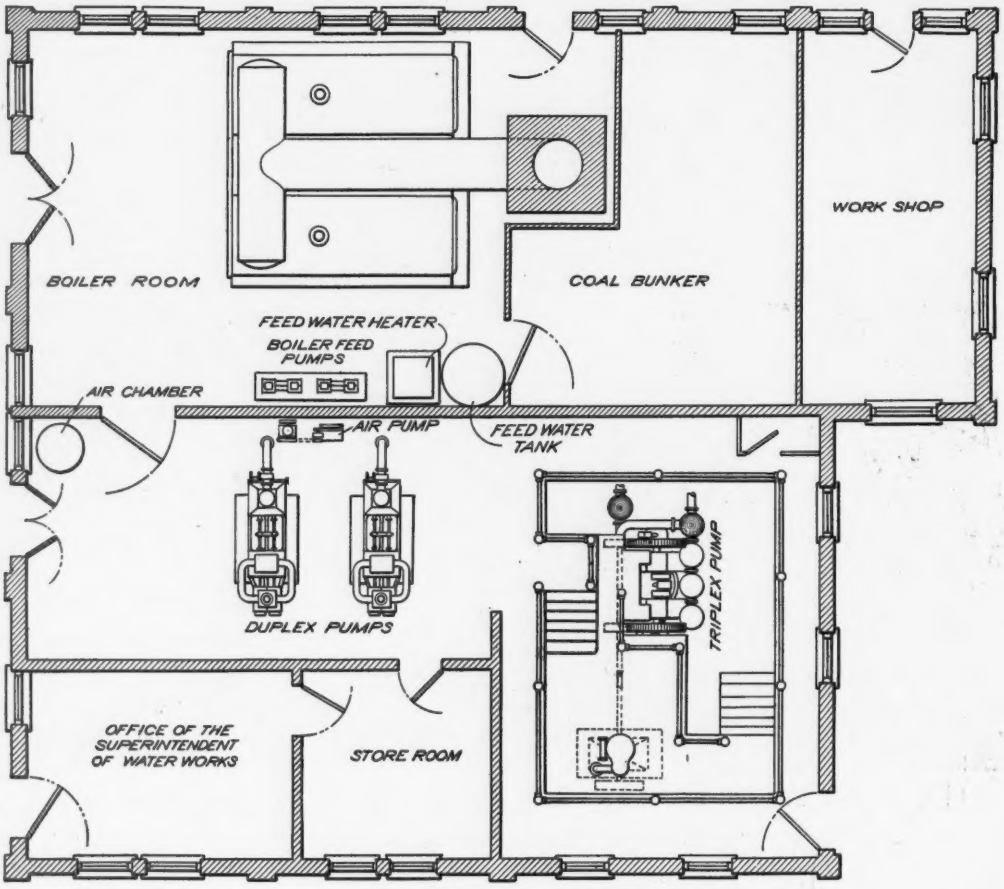


FIG. 3. GENERAL PLAN OF PLANT

Feed Water Supply

DURING the operation of the plant it was found that the water which was pumped from the wells contained too much scale-forming material to be of value as feed water for the boilers, consequently a pipe line was laid to a creek about 800 ft. from the plant which supplies practically soft water. The level of the creek being only a few feet below the floor of the boiler room, the water is pumped by means of a Canton-Hughes duplex steam pump, 5½ by 3½ by 6 in., placed in the boiler room, to a storage tank of about 10 barrels capacity. From this storage tank the water flows by gravity through a 100-hp. Cochrane open feed-water heater to the boiler-feed pump which is a duplex Monitor, 4½ by 2¾ by 4 in. Both pumps are regulated by hand and are supplied with Detroit lubricators.

Exhaust steam from the pumping engine is used in the heater for raising

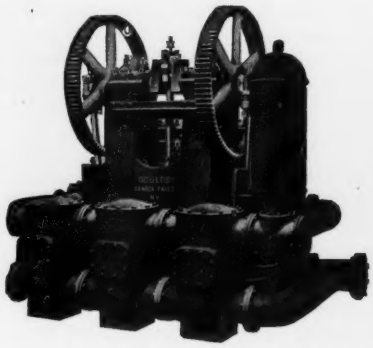


FIG. 5. GOULDS TRIPLEX DOUBLE ACTING PUMP

the temperature of the feed water and there has been no difficulty experienced with boiler scale since the creek water and the feed-water heater have been employed. As an auxiliary method of feeding the boilers, a Detroit injector is employed, at which times cold water is fed directly to the boiler from the storage tank.

Engine Room

IN the engine room are located 3 pumping units consisting of 1 main pump and 2 auxiliaries. The principal unit is a Goulds double-acting triplex piston pump, operated by direct connection to an engine made by Engberg's Electric & Mechanical Works. This pump is placed in a pit 15 by 20 ft., and 11 ft. deep. It has 3 cylinders 12 by 14 in. with a capacity of 2,000,000 gal. in 24 hr. The frame consists of 2 standards which rest on foundations and carry the end cylinders. The standards are held together by the center crosshead guide and the cylinder base bolted between them. The crank shaft is of steel forging and works in bearings of phosphor bronze, the pinion shaft bearings being of babbitt metal. Double gearing is employed, the wheels being made of charcoal iron and machine cut from the solid casting. Gear guards cover the pinions and adjacent teeth of the gears.

The cross heads are fitted with adjustable bronze shoes which run in bored guides and the connecting rods are of forged steel fitted at each end with adjustable bronze boxes of the marine type. The cylinders are bolted to the base and are of separate castings made of charcoal iron with bronze linings bolted in to make them easily removable. Pistons are made with followers and fitted with fibrous packing, and piston rods are of cold rolled steel. Stuffing boxes and glands are made of bronze fitted with fibrous packing and of easy access for adjustment. Separate charcoal iron castings are used for the valve boxes each containing a set of suction and discharge valves, the total number being 120. Rubber disks on bronze grid seats are

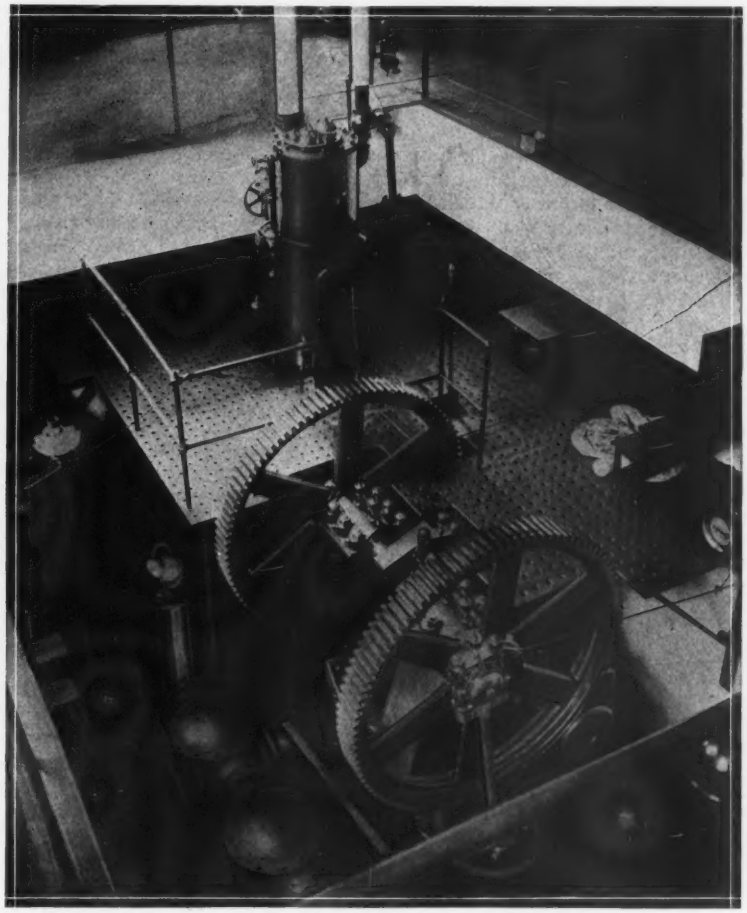


FIG. 4. MAIN PUMPING UNIT IN PIT

employed in the valves and have cylindrically wound springs.

The pump is supplied with an air chamber on the discharge end and a vacuum chamber on the suction pipe of the pump which relieves all possible strain due to water hammer. The system of lubrication is by means of oil cups placed upon the bearings of the pump. The maximum speed of the pump is 30 r.p.m., but it is normally run at 24 r.p.m., with a discharge pressure of 55 lb. normal when pumping to the standpipe. In case of fire the pressure is raised to 100 lb. and placed direct upon the water mains. The normal suction pressure is about 15 in. vacuum. The pump is equipped with an Ashcroft revolution counter, which enables the attendant to estimate the amount of water being used.

As stated above the pump is driven by a vertical

engine made by Engberg's Electric & Mechanical Works, which is direct connected to the shaft of the pump by means of a Tutten friction clutch. The engine cylinder is 15 by 15 in., and equipped with a valve of the piston type. The engine runs at a speed of 90 r.p.m., and is supplied with steam pressure at from 100 to 110 lb. The exhaust from the pump is used in heating the feed water and also for heating the building in the winter time.

Auxiliary Pumps

PRIOR to the installation of the triplex pump, 2 Hughes Steam Pump Company's duplex pumps did all the pumping of the plant; these are at present used as auxiliaries. These pumps have water cylinders 12 by 14 in., and tandem compound steam cylinders 18 and 10 by 14 in. They are equipped with Ashcroft revolution counters and oiled by means of Detroit lubricators. Air chambers are placed on the discharge pipes from each pump and an additional air tank 3 by 12 ft. is installed in the pipe line to take care of any water hammer which may occur in the system.

Some difficulty was encountered in priming these engines and to overcome this trouble a former chief engineer, Geo. S. Round, made a small air pump which is driven by a vertical marine type engine with a cylinder 4 by 4 in. During the operation of the auxiliary pumps this air pump is kept working to discharge all the air from the suction line as some of the wells draw considerable gas.

The gage board in the engine room has placed upon it 4 Crosby indicating gages, one for indicating steam pressure, another suction, the third standpipe pressure, and the fourth indicates the high pressure or discharge during times when the engine pumps direct to the water mains. Aside from these a Crosby recording water gage is employed, and, to warn the operator against overflowing the standpipe, an alarm gage is employed.

The standpipe is placed about 400 ft. from the pumping station and is 12 ft. in diameter by 100 ft. in height with its base 10 ft. above the main pump, thus giving a pressure of 55 lb. upon the discharge of the pump. The gate valves used in handling the water through the mains in the station are of the Burnham type.

A hand-operated plant is one of the most difficult to keep in repair and operate efficiently, and in this plant, as will be noted in the illustrations, remarkable cleanliness is encountered, and economical operation secured through the efforts of the chief engineer, B. R. Adams, and his assistant, Thomas Brant, who have entire charge of the plant night and day.

ECONOMICAL AIR COMPRESSION

By Henry L. Dean

FOR any but the smallest compressors, compound compression is desirable, and its adoption with adequate intercooling between the cylinders is needed for good economy. This subject has been discussed so much and is everywhere so familiar as to require no further comment, and we will deal here with the subjects of steam compounding as applied to air compressors, and a comparison of the duplex and straight line types, about the relative advantages of which there is much divergence of opinion.

Advantages of Steam Compounding

WHILE the process of expanding steam in 2 or more cylinders is well understood as applied to general steam engine practice, the peculiarities of compressor operation produce conditions where compound steam driven compressors can show better results than compound stationary engines of the same size and type. There is a simple reason for this fact.

As is well known, marine engines are almost universally compound or triple expansion. These run under high pressure, usually condensing, and the load is constant. Steam pumps are also compounded to advantage, but in this case we also have a constant load. Stationary steam engines are commonly compounded if condensing water is available and the units are of considerable size, but, for average conditions in small or medium sized plants, the load variations make any gain from compounding doubtful.

To get the full advantage of steam expansion in compound engines, the point of cutoff should remain almost constant at the point fixed by the ratio of the 2 cylinders. Any great deviation from this point changes the relation of the cylinder volumes, consequently the losses due to excessive expansion and condensation may detract from the economy expected of compounding.

As stationary engines run at constant speed under a varying load, the governing is performed by shifting the point of cutoff, which at once leads to the defects noted above and explains why small or medium sized engines are seldom compounded.

Air compressors on the other hand meet the varying demands for air by a change of speed, the load for each stroke being constant at all speeds for a given receiver pressure. All governing variations being as to speed only, the cutoff can be set at the point determined by the cylinder ratio for best economy, and the compressor controlled by a throttling governor.

From the foregoing discussion it is seen where air compressors can be steam compounded with much greater economy than general power engines and can easily perform to advantage on an initial steam pressure of 75 lb. condensing, especially where fuel is expensive. In new installations, however, pressures around 125 lb. can be arranged for, and as this is quite suitable for compounding, the saving in the boiler equipment to furnish the reduced amount of steam required, will usually offset the extra cost of a compound machine.

Duplex Arrangement

HAVING decided that compressors may be advantageously steam compounded, I here make the positive statement that probably there is not a case where a double tandem compound machine with 4 cylinders on 1 piston rod, has been entirely satisfactory. The arrangement of 4 cylinders in a straight line machine leads at once to a complicated, inaccessible construction, for both adjustment and replacement, greatly increases the cost, and at the same time gives excessive stresses on bearings, rods and boxes, and inability to run at slow speeds. This naturally leads to a discussion of the duplex construction, in the course of which it seems advisable to point out the fundamental conditions imposed on a steam driven compressor.

Fundamental Conditions of Steam Driving

LOOKING at the air end, we see that when air is compressed in a cylinder the pressure in front of the piston varies, rising from atmospheric pressure the moment the inlet valves close, to about the receiver pressure when the discharge valves open either automatically or mechanically. When this latter pressure is reached it remains practically constant until the end of the stroke. On the reversal of the stroke in a double acting cylinder the process is repeated on the other side of the piston. Thus we have minimum resistance and power required at the beginning of the stroke, both of these factors rising to a maximum value at which they remain constant until the end of the stroke.

In the steam end the processes are, however, exactly opposite to those in the air end. With the piston at one end of its travel, steam is admitted at boiler pressure on one side, driving the piston forward. The pressure doing work on the piston remains constant up to the point of cutoff, when it gradually drops as the expansion of the steam takes place, falling to a minimum when the exhaust valve opens. The process is repeated on the return stroke. Hence in all steam driven compressors we have a maximum pressure applied to a minimum resistance, at the beginning of the stroke, the power falling and the load increasing until the former has its minimum and the latter its maximum value at the end of the stroke.

The defects of and objections to such a process must be evident when we consider the stresses and vibrations produced by the unbalanced pressures and sudden reversals of forces, and it is to minimize the inherent difficulties of air compression that the duplex machine has been developed.

Duplex Compressor Advantages

BY the term duplex we refer to that type composed of 2 elements, each consisting of a steam cylinder and one or more air cylinders in tandem. These units are united by a crank shaft, carrying a flywheel between the bearings, and having disks whose crankpins are set at 90 deg. from each other. Right here appears one great advantage of the duplex over the straight line, for with the pistons on one side of the duplex at the end of their stroke we have an excess of resistance over power, while on the other side the pistons being practically at half stroke we have an over abundance of power. This is transmitted through the shaft and applied toward helping the side carrying the heavier load. There are points of the stroke where the total power exceeds the total resistance and this surplus energy is stored in the flywheel to be returned at some other point where the total resistance predominates.

It is evident from the above, that the angular arrangement of the cranks makes possible the use of a lighter flywheel to compensate for the load variations, and at the same time relieves the bearings of much of the enormous thrust exerted in a straight line when passing the centers.

The absence of any dead center in a duplex allows the closest possible governing and yet, as the load for each stroke is constant at all speeds, the cutoff can remain unchanged at its shortest practical point without the machine centering. In practice machines are easily run on at least 3/8 cutoff and will start themselves after complete stoppage, and simply moving the cutoff adjustment will start the machine again should it actually become centered.

On the other hand, a straight line machine cannot be governed to run much below 1-3 speed and then only on a late cutoff, hence a cutoff late in the stroke becomes very common, and, this gives no better than plain slide valve results. A consideration of these facts will show the increased economy of duplex over straight line except perhaps when the latter is run constantly at its uniform maximum load.

We see, that compounding is possible in the duplex type without the addition of extra cylinders, valves or other parts and without making the machine inaccessible or cumbersome. These features and the ease with which all parts of the duplex may receive inspection, adjustment and lubrication, tend toward a steady running, economical machine, where the wear on parts is slight, and breakdowns infrequent.

It is, however, foolhardy to suppose that every double cross compound compressor will show improvement over straight line machines along the lines noted

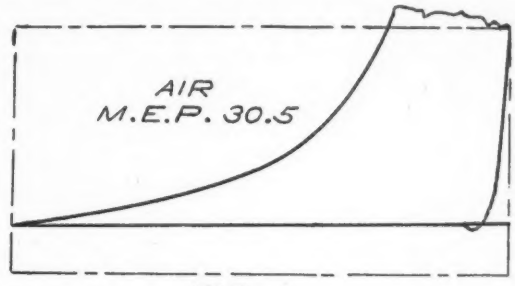


FIG. 1

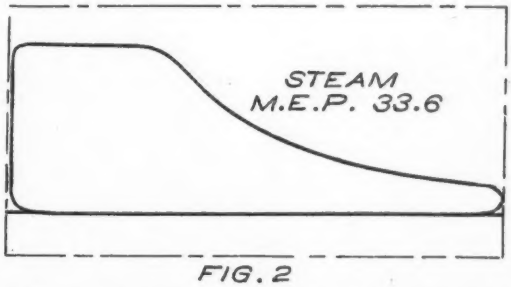


FIG. 2

FIG. 1. DIAGRAM FROM AIR END OF COMPRESSOR
FIG. 2. CORRESPONDING DIAGRAM FROM STEAM END OF AIR COMPRESSOR

above. To be more economical, both mechanically and in the use of fuel, a duplex machine must be a first class product throughout, correctly designed and proportioned, well constructed with close attention to details, and intelligently operated; such a machine is sure to justify its selection.

Practically the only points in favor of the straight line type are its first cost, a saving in foundations and in floor space. As the average purchaser thinks only in dollars and cents, a concrete example will be given to show where, neglecting all mechanical economies, the savings in operating expenses will soon pay the first cost difference, and eventually the entire cost of the duplex. As the simple steam, 2-stage straight-line and the double-compound duplex each represent the best machine of its type, comparisons will be made only between these 2 classes.

Comparison of Types

SUPPOSE that a compressor is desired to furnish 500 cu. ft. of air a minute, delivering to a receiver at 100 lb. gage. A 2-stage machine of that capacity will require approximately 92 i. hp. to perform the work,

and we add the fact that the straight line cannot run under a minimum of 30 hp., even though the air used may not exceed 10 hp. for a total of several hours throughout the day.

Now, while the best straight line compressors are furnished with Meyer valves, as noted before, they are almost habitually set by the operators to cut off at about 0.75 stroke. This is an actual fact, and with such setting they will require on an average 45 lb. of steam a horsepower an hour. The Meyer valve and Corliss duplex machines with their 90-deg. cranks and set for short cutoff will require respectively under average conditions 26 lb. and 15 lb. of steam a horsepower an hour.

The above figures are average results under working conditions and are taken to be perfectly fair to each class of machine. Considering 30 lb. of steam evaporated an hour as one boiler horsepower, we have the following boiler horsepowers necessary to operate the respective machines.

Two-stage straight-line;

$$\frac{92\times45}{30} = 138 \text{ boiler hp.}$$

Meyer valve double-compound duplex;

$$\frac{92\times26}{30} = 80 \text{ boiler hp.}$$

Cross-compound Corliss;

$$\frac{92\times15}{30} = 46 \text{ boiler hp.}$$

A comparison of these results shows at once the saving possible in boiler installations and auxiliaries, and no further comment is necessary on this subject.

Referring to the figures again, shows that the Meyer duplex uses 1748 lb. and the Corliss duplex 2760 lb. of water an hour less than the straight-line. If water has to be purchased at all the saving here is at once evident, but it is in economy of fuel that the best results are shown. As 1 lb. of coal will evaporate 7 lb. of water we see that the savings in fuel cost alone with coal at $3 a ton, for a year of 300 days of 10 hr. each, will be, for the Meyer duplex,

$$\frac{1748\times10\times300\times3}{7\times2240} = \$1{,}003.$$

For the Corliss duplex,

$$\frac{2760\times10\times300\times3}{7\times2240} = \$1{,}584.$$

In closing, the writer is hopeful that the preceding discussion is not considered as condemning the straight line compressor, but rather in praise of a higher class of machine, one more economical and efficient and one whose value is destined to be more fully appreciated as the use of compressed air as a power becomes more extended.

H. Harrison Kress, for a long time in charge of the advertising of the A. S. Cameron Steam Pump Works, has resigned his position to become associated with the Jeffrey Mfg. Co., of Columbus, O. Mr. Kress has also been secretary of the Technical Publicity Association and at its last meeting resolutions were adopted and a beautifully embossed set of them bound in leather was presented to Mr. Kress by T. H. Gale, of the General Electric Co.

TURBO GAS BLOWERS

During recent years the perfecting of the small steam turbine has supplied a most desirable form of power for driving the centrifugal type of gas blower. Air pressure commonly used in gas machines is from about 8 to 16 oz., and the speed required for the centrifugal blower, for highest efficiency when discharging against these pressures, is directly within the limits of the most economical turbine speeds. The turbine and blower are mounted on one cast-iron base. A flexible coupling connects the 2 shafts, avoiding any trouble from possible poor alignment.

Under these favorable speeds, the more economical makes of small turbines will consume but a small amount of steam per brake or shaft horsepower. The direct

FIG. 1. TERRY TURBINE, NONCONDENSING GAS BLOWER SET WITH CAPACITY OF 6000 CU. FT. A MINUTE

connected turbine saves the power otherwise lost in belting, and the delay and expense of renewing the belts.

Beyond being economical, the turbo-blower sets are reliable. The bearings of the turbine and blower are the only moving contact surfaces, and as these are of ample size, with ring oilers, and large oil reservoirs, the unit requires practically no attention. In one station operating turbines, the oil in the reservoirs is changed once a month. The bearings are very large for the weight supported, and as the action of both the turbine and blower is purely rotary, little, if any, duty is placed on the bearings other than supporting the weight of the rotating parts.

Contrary to the general opinion, experience shows that in the better class of small turbines the buckets and nozzles are not subject to erosion by the steam to any degree sufficient to decrease their efficiency. Geo. A. Orrok, in his paper on small turbines read at a recent meeting of the A. S. M. E. in Washington, says: "A number of turbines have, to my knowledge, run more than 18 months without a cent spent on them for maintenance. Apparently there is no wear in nozzles, buckets or return champers. The only wearing parts are the bearings, and these are generously proportioned."

If, at stated intervals, the bearings are cleaned and the oil replenished in the reservoirs, no other attention is required. These reservoirs are usually large, and a 3-months' continuous run is not uncommon.

The turbine blower set lends itself admirably to the intermittent service usually employed. The throttle valve, which is often operated at some distance from the operating platform, by a rope or rod, is fitted with a small

bypass pipe, passing only sufficient steam to keep the turbine turning over slowly when the valve is closed.

Upon opening the throttle the turbine at once comes up to speed, and the blower is ready to take the load, when the gate on the blower discharge duct is opened. In some cases, instead of using a bypass, the valve is left slightly open. Under the above arrangements practically no steam is used during the no-blast periods.

It often occurs that more air is required through the gas generator than the blower set was originally installed for. The pressure required to force an increased volume of air through any fixed areas or systems, such as a bed of coal, varies directly as the square of the volume. Similarly, when a centrifugal blower is speeded up to give an increased volume, it will deliver the air at an increased pressure corresponding to the square of the volume. Therefore, under the new conditions the blower will still be running under maximum efficiency.

The increased power necessary (which varies as the cube of the increased air volume) can generally be obtained from the turbine without serious alterations. With some designs, it is only necessary to fit 1 or more extra steam nozzles, and these give increased efficiency with the increased power. Many of these turbines have been in service driving gas blowers for more than 5 years.

Forms of the turbine gas blower made by the Terry Steam Turbine Co., 90 West St., New York, N. Y., are shown in the illustrations.

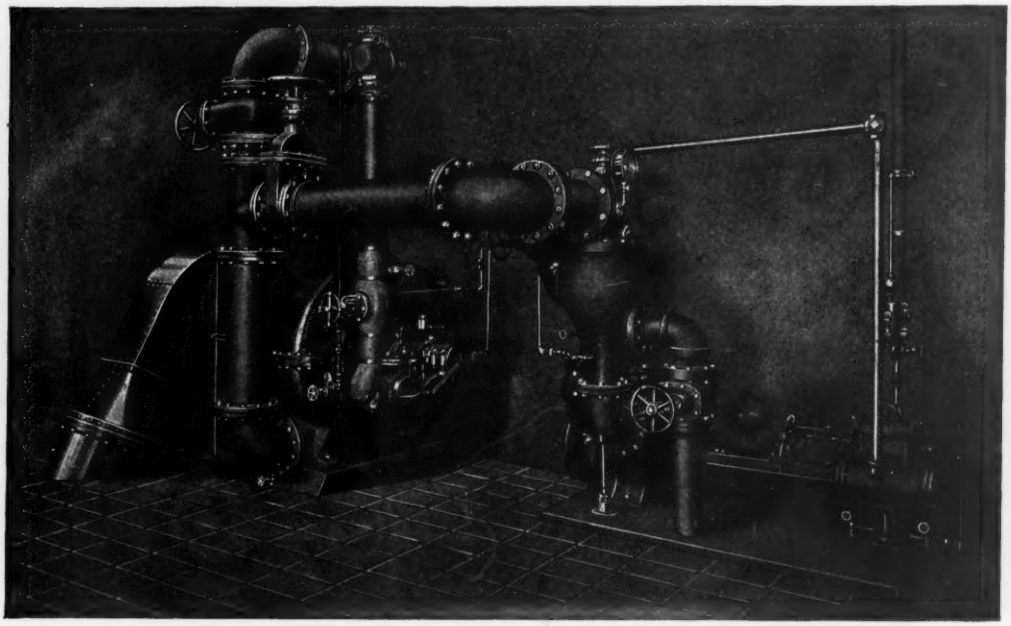


FIG. 2. TERRY TURBINE DRIVING 14,000 CU. FT. A MINUTE GAS BLOWER WITH JET CONDENSER

THE GRISCOM-SPENCER CO., 90 West St., New York, announces the acquirement of the rights, patterns, drawings, unfinished material and stock, and current orders of the Goubert Manufacturing Co., long and favorably known as manufacturers of the Goubert feed-water heater and the Stratton steam separator. The Griscom-Spencer Co. has also secured the services of A. A. Goubert, who will continue to manage the business in connection with the sale of the Goubert specialties, which this company will manufacture in addition to its regular well-known line of Reilly Multicoil feed-water heaters, evaporators, and distillers.

INTERDEPENDENCE

THE soul is a lonely thing at best; whence it came, it knows not at all; whither it goes, it knows as little; what it is doing here, and how, it knows least of any. To expand in a little kindness and be grateful, to communicate a little strength or cheer and be content—that is all it looks for. Without the love of our fellows we are leafless stocks, cumbering the ground; we are waterless wells, mocking our own need. For all that is given we may give again in thankfulness and devotion; but only as seed is sown can earth bear fruit, only as we are loved can we love again. Let no man think he can give and not receive. As soon could hollows in desert sand turn to green pools girt about with whispering reeds and flowering rushes. Surely as the babe smiles up because the mother smiled, so do we give all because to us, desertless, all has been given. Let a man count for one day the services, the friendliness, the trivial kindly deeds, the pleasant tones, the smiles, merely that have fallen like dew upon him. He will never again reckon himself independent of his kind. Upon all that are near or dear he leans for sympathy, for comprehension, for courage. His very virtues are fed from without. How much do we owe to our friends' ideal of us? How much to their own high standard, of which we must not fall short for mere shame? How much of fortitude we share in the mere presence of lofty endurance, of uncomplaining pain, of submission where hope is not? When we are afraid, sometimes, of the sight of sickness, when we would hide it away in hospitals, banish it to the woods and wilds, we are forgetting how we depend for our own courage on those who are practised in terrible virtues of endurance. The very contemplation of these virtues has power itself to communicate strength; they purify the soul, they fortify it, and finally they impart a special grace. Little as we reckon it, we lean constantly upon the invalids, the unfortunate, the troubled hearts.—Harper's Weekly.

EXPERIENCES WITH SUPERHEATED STEAM

AMOUNT OF SUPERHEAT DESIRABLE AND COMPARATIVE ACTION OF CAST IRON AND CAST STEEL FOR PIPE LINES

FROM a paper by Dr. D. S. Jacobus, read before the National Association of Cotton Manufacturers, and from discussions on the subject of cast-iron fittings for superheated steam, before the American Society of Mechanical Engineers, the following data have been abstracted, covering the most recent knowledge and progress in the use of superheated steam for power plants.

Dr. Jacobus states that experience has shown that when the superheater is so arranged that the economy of the boiler and superheater combined is as high as the economy of the boiler without a superheater, there will surely be a gain from the use of superheated steam. The amount of this saving varies from 3 per cent to 15 per cent for 100 deg. of superheat, for large and highly economical steam turbines or piston engines which have a high ratio of expansion, or may run up to from 10 per cent to 25 per cent for 100 deg. of superheat when the steam motors are less economical. On locomotive engines are shown savings of from 10 to 19 per cent with the superheat at 130 to 200 deg.

Efficiency of Boiler Plus Superheat

TAKING as efficiency the ratio of the heat contained in the steam on leaving the boiler or the boiler and superheater to the heat of combustion of the fuel burned as determined by calorimeter test, it has been shown beyond doubt that as high efficiency is obtainable with a boiler and properly designed superheater as with one furnishing saturated steam. Dr. Jacobus stated that in tests on oil-burning boilers he had obtained as high as 83 degrees efficiency with steam heated to 100 deg. F. above the pressure due to the temperature and that only about 2 per cent was lost in radiation. This required of course, the most careful adjustments and care in regulating the air supply, but proves that the superheater does not produce the efficiency of the plant. He would have the superheater so arranged that the gases pass partly over the superheating and partly over the boiler heating surface, but not by carrying a part of the gases to the superheater alone, as this may result in a lowered efficiency.

Limits of Superheating, and Amount of Saving

ALL accurate tests show that there is a saving in the heat consumption of an engine using superheated steam. To make this plain it is needed to explain what is meant by heat consumption of an engine. If an engine uses, say, 15 lb. of steam an hour per horsepower, it does not follow that it will have the same heat economy as another engine using 15 lb. an hour, because in one case the steam pressure may be higher than in the other, and the feed water may be returned to the boiler at a high temperature in one case and a low temperature in the other.

If we determine for each of the engines heat imparted to the boiler per indicated horsepower, a comparison of these figures will give a true measure of the relative economy. This has led to determining the heat consumption of an engine, based either on actual temperature of the feed water or on the temperature at which the feed water would be returned to the boiler with proper forms of feed-water heaters.

There is still a deep rooted feeling in the minds of some engineers that the use of superheat involves operating difficulties not met with saturated steam, but the fact remains that steam turbine and engine men stand ready to guarantee reliability for superheated steam, and where piping is properly designed and installed there will be no greater difficulties than with saturated steam. This refers to what is known as moderately high superheat, say 100 to 200 deg. F., for the higher degrees of superheat, apparatus of special nature must be used, and it is a question whether additional care and liability of operating difficulties will not offset additional saving.

Distortion of Fittings

UNDOUBTEDLY in some cases superheated steam has deteriorated cast-iron fittings, whereas in others with superheat averaging 150 deg., such fittings have been used with entire satisfaction. It appears that the difference may arise through the quality of the cast iron used. In some cases cast-iron fittings have been found to increase in size and to become distorted so as eventually to cause leakage, and in other cases cracks have been developed. In this connection some data from the discussions before the American Society of Mechanical Engineers are interesting.

In one case where 10 in. extra heavy valves were used with ribs running between the end flanges and also between the bonnet flange and end flanges these ribs were cracked from 1 in. to 1½ in. deep, and in one place on the body small criss-cross cracks were revealed by the microscope. The valve was originally 18 in. long, but after 2.5 years of exposure to 150 deg. superheat, this length had increased to 18 7/32 in. The iron on breaking up was very coarse, with crystals something like ⅛ in. across. Evidently the valve was of poor material to start with.

Geo. A. Orrok of the New York Edison Co., stated that they had had some trouble with cast-iron piping and fittings and valves, but that with cast steel there had been no trouble. He stated that in examining fittings taken from a superheat line all had undergone a growth in size, and the outside was covered with fine hair cracks. He thought that this might be due to the fact that in a superheat steam line, there may be a stream of water flowing along the bottom of the pipe when there is 200 deg. superheat in the upper part, thus causing a tendency to blowing in the fittings as well as in the piping.

R. K. Mitchell told of experiences with cast-iron fittings in a street railway plant where the length of an 8-in. tee which was originally 35 in., increased to 35¾ in.

With an independently fired superheater, it is possible to overcome some of the variations due to changes in load, but the danger of obtaining a high degree of superheat is just as great as when the superheater is within the boiler setting. Overheating in an independent superheater usually occurs when an accident happens which requires immediate shutting down of the plant. In such cases, especially if the fireman becomes excited, he may forget to open up the firing door so as to allow cold air to pass through the superheater, or to cover up the fires to reduce the heat. In such a case the superheater may become burned or, if there is a slight flow of steam from the superheater to some auxiliary engine or pump, the temperature of the

steam may be so high as to cause trouble. This may be taken care of by setting the safety valve on the superheater a few pounds less than the main safety valves on the boiler so that a circulation of steam may be provided through the superheater.

Results from Tests

TESTS made on the steam yacht Idalia to determine the comparative economy with and without superheating, showed that with superheated steam supplied to all the engines, auxiliary as well as main at 105 deg. superheat and at practically 200 lb. pressure the saving was 15.3 per cent of steam and 10 per cent of heat. These tests showed that with saturated steam the steam consumption was about 18.3 lb. per horsepower-hour, and the heat consumption 214 B. t. u. per horsepower per minute.

With 55 deg. superheat, the steam used was 17 lb. and the heat 300 B. t. u. With 95 deg. superheat the steam used was 15.8 lb., and the heat 16.3 B. t. u. and with 105 deg. superheat the steam used was 15.5 lb. and heat 16 B. t. u.

Specific Heat of Superheated Steam

IN computing combined efficiency of boiler and its superheater, the specific heat of superheated steam must be used, and of late years a great deal of difference of opinion has arisen in regard to what this value should be.

Careful experiments have been made by Messrs. Knoblauch and Jakob of Berlin and by Prof. C. C. Thomas of Cornell University, the results being nearly the same except for high ranges of pressure. To place the work of these investigators in convenient form A. D. Pratt has averaged them, and compiled a table giving the average specific heat of steam above the saturation point, the final result of his work as given by Dr. Jacobus in his paper being as shown in the table herewith.

MEAN SPECIFIC HEAT OF SUPERHEATED STEAM AT DIFFERENT PRESSURES AND DEGREES OF SUPER HEAT

Gauge Pressure. — Pounds per Square Inch.	Superheat, Degrees Fahr., 50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°	190°	200°
35	.532	.527	.523	.520	.517	.515	.513	.510	.509	.508	.507	.505	.504	.503	.502	.501
40	.536	.531	.527	.524	.521	.518	.516	.514	.513	.511	.509	.508	.507	.506	.505	.504
45	.540	.535	.530	.527	.524	.522	.519	.517	.516	.514	.512	.511	.510	.509	.508	.507
50	.544	.539	.534	.531	.528	.525	.523	.521	.519	.517	.515	.514	.513	.511	.510	.509
55	.547	.542	.538	.534	.531	.528	.526	.524	.522	.520	.518	.517	.515	.514	.513	.512
60	.551	.546	.542	.538	.535	.532	.529	.527	.525	.523	.521	.519	.518	.516	.515	.514
65	.555	.549	.545	.541	.538	.535	.532	.530	.527	.525	.523	.522	.520	.519	.517	.516
70	.558	.553	.548	.544	.541	.538	.535	.532	.530	.528	.526	.524	.523	.521	.520	.518
75	.561	.556	.551	.547	.544	.541	.538	.535	.533	.530	.528	.527	.525	.523	.522	.520
80	.565	.559	.554	.550	.547	.543	.540	.538	.535	.533	.531	.529	.527	.525	.524	.522
85	.568	.562	.558	.553	.550	.546	.543	.540	.538	.535	.533	.531	.529	.527	.526	.524
90	.571	.566	.561	.556	.552	.549	.545	.543	.540	.537	.535	.533	.531	.529	.528	.526
95	.575	.569	.564	.559	.555	.551	.548	.545	.542	.540	.537	.535	.533	.531	.529	.528
100	.578	.572	.566	.562	.557	.554	.550	.547	.544	.542	.539	.537	.535	.533	.531	.530
105	.581	.575	.569	.564	.560	.556	.552	.549	.546	.544	.541	.539	.537	.535	.533	.531
110	.584	.578	.572	.567	.562	.558	.555	.551	.548	.546	.543	.541	.539	.536	.535	.533
115	.587	.580	.574	.569	.565	.561	.557	.553	.550	.548	.545	.543	.540	.538	.536	.534
120	.590	.583	.577	.572	.567	.563	.559	.556	.552	.549	.547	.545	.542	.540	.538	.536
125	.593	.586	.579	.574	.569	.565	.561	.558	.554	.551	.549	.546	.544	.541	.539	.538
130	.595	.588	.582	.576	.571	.567	.563	.560	.556	.553	.551	.548	.545	.543	.541	.539
135	.598	.591	.584	.578	.574	.569	.565	.561	.558	.555	.552	.549	.547	.544	.542	.540
140	.601	.593	.586	.581	.576	.571	.567	.563	.560	.556	.554	.551	.548	.546	.544	.542
145	.603	.596	.589	.583	.578	.573	.569	.565	.561	.558	.555	.552	.550	.547	.545	.543
150	.606	.598	.591	.585	.579	.575	.571	.567	.563	.560	.557	.554	.551	.549	.546	.554
155	.608	.600	.593	.587	.581	.577	.572	.568	.565	.561	.558	.555	.553	.550	.548	.545
160	.611	.602	.595	.589	.583	.578	.573	.570	.566	.563	.560	.557	.554	.551	.549	.546
165	.613	.605	.597	.591	.585	.580	.575	.571	.568	.564	.561	.558	.555	.552	.550	.548
170	.615	.607	.599	.593	.587	.582	.577	.573	.569	.565	.562	.559	.556	.554	.551	.549
175	.618	.609	.601	.594	.588	.583	.578	.574	.570	.567	.563	.560	.558	.555	.552	.550
180	.620	.611	.603	.596	.590	.585	.580	.576	.572	.568	.565	.561	.559	.556	.553	.551
185	.622	.613	.605	.598	.591	.586	.581	.577	.573	.569	.566	.562	.560	.557	.554	.552
190	.625	.615	.607	.599	.593	.587	.583	.578	.574	.570	.567	.564	.561	.558	.555	.553
195	.627	.617	.608	.601	.595	.589	.584	.579	.575	.571	.568	.565	.562	.559	.556	.554
200	.629	.619	.610	.602	.596	.590	.585	.580	.576	.572	.569	.566	.563	.560	.557	.555
205	.631	.621	.612	.604	.597	.592	.586	.582	.577	.573	.570	.567	.564	.561	.558	.555
210	.633	.623	.613	.605	.599	.593	.588	.583	.578	.574	.571	.568	.565	.562	.559	.556
215	.635	.624	.615	.607	.600	.594	.589	.584	.579	.575	.572	.568	.565	.562	.560	.557

FOR CHEAPER COAL

AN interesting suggestion is made by J. F. Lorenz, in a paper read before the National Association of Cotton Manufacturers, in regard to buying and handling steam coal. He suggests that the coal users of a certain section should combine to establish a standard for coal carrying vessels or cars, and that only such vessels or cars should be used to ship coal into that region. Where vessels are used, standard unloading plants should be established, for the prompt unloading of such vessels into cars or yards, and plants should also be established for the prompt unloading of cars. In this way the most rapid handling of the fuel could be secured and a large saving made in the cost of the fuel for the plants so cooperating. He recommends also the employment of experts to study combustion conditions in each plant, and recommend the best fuel and the methods of firing for each plant. According to a plan which has been carried out by the steam producers in Hamburg, Germany, with the best of success.

THE BRITISH RADIUM CORPORATION has recently had a safe made for holding radium to the amount of 100 lb. valued at $5,000,000,000. A 3-in. wall of lead is built inside the steel shell to prevent emanation and means are provided for collecting the emanation before the safe is opened.

STEAM AND AIR FLOW METER

OVER a hundred years have passed since James Watt perfected a steam engine with practical operating qualities, yet up to the present time in neither the generation, transmission or utilization of steam has the just due of operating economy been realized. The engineering profession is proud of the many advances made in the construction of boilers, the provision of suitable steam transmission equipment and the perfecting of highly efficient engines and turbines; but in the really vital point—measurement—the engineer has had to be content, like Watt, with the knowledge that enough steam was being generated to do a certain amount of work. Though he has kept an accurate record of coal and water consumed by boilers, he has had no means of knowing how much steam was being delivered to the prime mover—how much utilized, how much wasted.

The necessity for the conservation of our national resources and the sharp competition which makes every economy, however slight, a matter of great importance impressed the engineers of the General

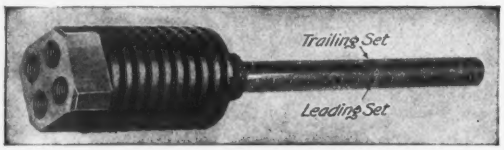


FIG. 1. NOZZLE PLUG OF THE STEAM FLOW METER

Electric Co. over 4 yr. ago with the fact that a means of doing away with guesswork in handling steam would be a wonderful boon to the engineering world. Experiments were undertaken at that time with a view to perfecting a practical steam meter, and as a result of over a thousand actual tests and the expenditure of large sums of money, such an instrument is now on the market.

There have been developed a Recording Steam Flow Meter, 2 types of indicating Steam Flow Meters and an Indicating Air Flow Meter, each of which will accurately measure the rate of flow of steam, air or other gases, as the case may be, in any size pipe, under any conditions of pressure and temperature met in commercial practice.

The principle governing the action of the flow meter is a modification of that of the Pitot tube. A brass nozzle plug, screwed into the pipe at the point where the flow is to be measured, carries 2 sets of openings: a leading set, facing the direction of flow and extending diametrically across the pipe; and a trailing set, consisting of 2 openings at 90 deg. and 1 at 180 deg. to the direction of flow.

Impingement of the steam against the leading openings sets up in them a pressure equal to the static pressure plus the pressure due to the velocity head, while the trailing set is acted on by the static pressure less that due to the velocity. The difference in these values is a measure of the velocity, and for constant temperature and pressure, gives the rate of flow. The pressure existing in the 2 sets of openings are communicated through separate longitudinal tubes to the outer end of the plug and from there by ¼-in. iron pipe to the meter.

Recording Steam Flow Meter

THE Recording Steam Flow Meter, Type R, Form D, is a curve drawing instrument, accurately calibrated to record the total rate of steam flow in pounds per hour in any diameter pipe at any condition of pressure, temperature or moisture.

In this meter there are 2 cylindrical hollow cups filled to about half their height with mercury and joined together at the bottom by a hollow tube; this U tube is supported on and free to move as a balance about a set of knife edges. The 2 pressures obtained by the nozzle plug are communicated to the cups by flexible steel tubing, whereupon the difference in pressure is equalized by a rising of mercury in the left-hand cup and a falling in the right-hand cup. Due

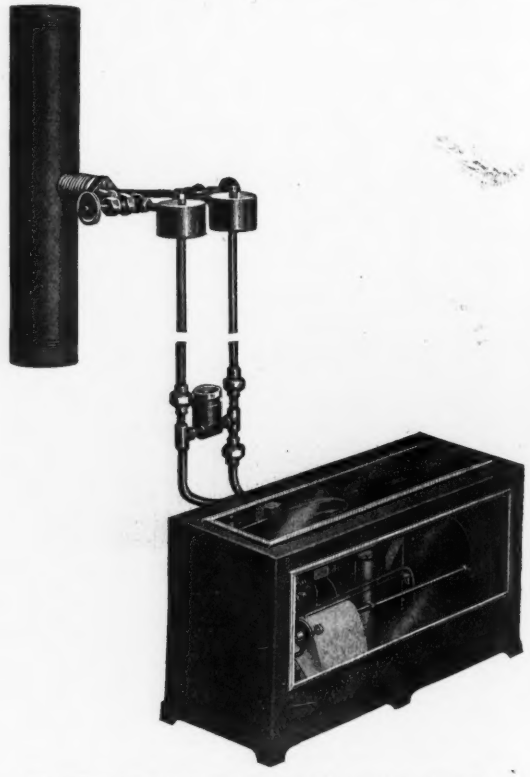


FIG. 2. THE RECORDING STEAM FLOW METER

to the displacement of the mercury, the beam carrying the cups tilts on the knife edges until the moment of the counterweights on the extreme right of the meter exactly balances the moment caused by the displacement of the mercury in the left-hand cup.

The motion of the beam is multiplied by levers and is registered by a pen. The time element of the meter consists of an 8-day clock driving a drum and feeding paper at the rate of 1 in. an hour. Charts are supplied in sizes to measure a flow of from 2000 to 240,000 lb. an hour, and of sufficient length to last 1 month. The rate of flow can be read at any instant or the average rate of flow calculated for a given time.

Automatic Pressure Correction Device

THE meter is adapted to any condition of pipe diameter, pressure, superheat or moisture by a hand adjustment of a correction weight on a graduated arm. A chart supplied with the meter shows the correct position for any existing condition.

If the pressure in the steam main varies more than 10 lb. from normal, compensation is necessary for the

error thus introduced. An automatic pressure correction device, consisting of a hollow spring similar to the pressure spring in a steam gage, is connected so as to be influenced by the static pressure of the steam at the point where the flow is being measured. Any variation of the static pressure causes the spring to expand or contract, and this movement actuates the small correction counterweight and affects the movement of the pen in such a manner that the recorded rate of flow is correct.

The meter weighs 55 lb. complete and is finished in nickel and dull black. As the glass front of the cover is removable, the working parts of the meter are readily accessible at any time.

Indicating Steam Flow Meters

TYPE I, Form F, Steam Flow Meter will meet general requirements where an indicating rather than a recording instrument is required. Owing to its simplicity of construction, light weight and durability, it

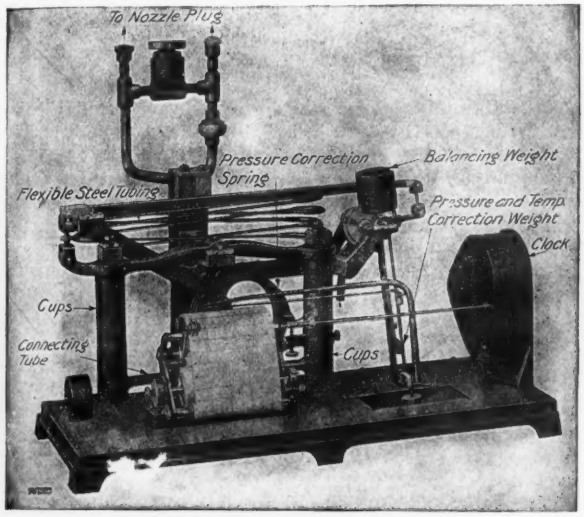


FIG. 3. ARRANGEMENT OF AUTOMATIC PRESSURE CORRECTION DEVICE

will be found especially useful for testing work, locating leaks, etc. The meter will indicate the rate of flow of steam in any size pipe, under any conditions of temperature or moisture at the pressure range for which the individual meter is designed. These ranges are: low pressure, 10 to 40 lb. abs.; medium pressure, 20 to 80 lb. gage; high pressure, 75 to 225 lb. gage.

The meter consists of an iron casting, cored out to form a U tube, and partially filled with mercury. The difference in pressures, as transmitted from the nozzle plug causes a difference in the mercury levels, and the displacement of the mercury actuates a pulley by means of a small float suspended by a silk cord. The pulley moves a small U magnet on the end of the shaft next to the dial in proportion to the change in level of the mercury in the U tube.

The indicating needle is mounted in a separate cylindrical casing. The pivoted end consists of a bar magnet, free to turn in the same plane as the magnet on the inside of the meter. The mutual attraction of the 2 magnets keep them parallel, so that a packed joint to transmit the motion of the pulley to the indicating needle is eliminated.

Proper adjustments for the existing conditions of pipe diameter, pressure and temperature are readily made by setting the graduated cylinder which actuates the rack carrying the pointer. When these settings are made, the rack is rotated by hand until the pointer coincides with the indicating needle. The point on the calibrated dial at the intersection of the needle and pointer gives the true instantaneous rate of flow in pounds per hour per square inch pipe area.

This meter is finished in nickel and black japan and weighs only 25 lb. A leather hand strap is supplied for carrying it.

The indicating air flow meter is identical in principle and method of operation with the indicating steam flow meter, except that water is used in the U tube as a working fluid and the chart dial is calibrated to read in cubic feet of free air per minute at 70 deg. F. per square inch pipe area. It is made in 2 ranges: low pressure 12 to 35 lb. abs., and high pressure 10 to 120 lb. gage.

All meters are carefully calibrated at the factory for operation under steady flow conditions, such as occur in supplying steam to steady flow turbines, to

FIG. 4. THE INDICATING FLOW METER

heating systems, for manufacturing purposes, etc.; it is not necessary to recalibrate the meter after installation.

The meters will not, however, accurately measure a periodically intermittent flow, such as is required by intermittent flow turbines, reciprocating engines, pumps, etc. In such a case, unless the meter can be placed so close to the boilers that steady flow conditions exist, recalibration for the existing conditions is necessary after installation.

Installation

STATION piping arrangements are not interfered with in installation, since it is necessary only to drill a ½-in. hole in the pipe and insert the nozzle plug. The plug must be placed in a straight run of pipe at least 10 pipe diameters from a preceding elbow or tee, and at least 2 pipe diameters before a following tee or elbow. The same nozzle plug is used for all types of meters, steam or air, the only difference being in the method of piping to the meter. The steam meter can be placed at any desired position below the level of the nozzle plug, provided the ¼-in. iron pipes to the meter have a slight downward slope throughout. As the piping for an air meter is not filled with water, the air meter can be placed at any desired position whatsoever, above or below the

nozzle plug. To operate the same meter on different sizes of pipes, it is thus necessary only to obtain the proper size nozzle plug for the pipe to be metered.

Some of the many uses for which the meters are adapted can be summarized as follows: For recording the total amount of steam generated by a battery of boilers; for equalizing the load on individual boilers of a battery; for discovering internal leaks in boilers, as shown by the difference in the water input and the steam output; for determining the deterioration of efficiency of a boiler due to formation of scale, etc.; for determining the efficiency of stoking; for measuring the amount of steam sold for power, heating or manufacturing purposes; for discovering losses originating from leaks between boilers and points of consumption, which could not be otherwise detected, as in defective traps, gaskets, valves, etc.

Already the great value of these meters has been demonstrated in many instances. In 1 remarkable case the boilers of a factory consumed ¼ the amount of coal on Sundays, when the factory was completely shut down, as on week days, when in full operation. Of course, the engineer knew that steam was being lost, but was unable to locate these leaks in the several miles of all sizes of steam pipes. The Steam Flow Meter located the leaks and effected a very considerable saving in steam.

Meters have been tried out in more than 50 power plants and factories and found thoroughly practical, being accurate, easy to install, interchangeable under all conditions, light, economical, cheap and possessing a long life.

REMINISCENCES OF AN ERECTING ENGINEER V

ASSEMBLING

By M. E. P.

WE have the shaft in place now and can congratulate ourselves that the most laborious job is done. We have the main bearings assembled and the caps put on, and then have a cover of some kind thrown over the disks and bearings so as to keep out all the dirt we can as the rest of the work goes along. It will save some trouble and work if we have this job of covering the bearings carefully done by filling all the places where dust could work into the bearings with clear waste.

The next part to be assembled will be the lower cylinder heads, or "frame heads" as they are called. These are hoisted up and bolted to the back columns and then the front columns are set in place and securely bolted. The next step will depend a little on the make of the engine. Usually it will be best to put up a part of the cast-iron foot plates so as to have a convenient means of getting around on the engine when the cylinders are being placed.

Placing the Low-Pressure Cylinder

IF the staging is so made that the front can be left off until later it will be best to erect what is necessary of the staging and then get the cylinders up. The low pressure will be the first one and it is also the harder to handle, as it is so large. We know that our crane will lift it safely as we have tried out the crane in handling the shaft, but just how to pick up the cylinder is something of a problem to one who has never had such a job to do.

It has been shipped from the shop with the cylinder head studs in place and the studs have the nuts on them for the sake of protection. When we have the cylinder under the door and are about ready to lift it, we must remove all the nuts from the bottom end studs and examine the studs very carefully to see that they have not been bent or cracked. Then the ground joint must be cleaned and inspected to see that there are no bruises on it so that there will be no leak when steam is turned on.

When this is all satisfactory, we can get a hitch on the cylinder and turn it up on its end. A couple of good blocks should be so placed that the end will land on them without allowing any pressure to come on the studs as the cylinder turns up. The next operation will be to sling the cylinder in some way so that it can be raised and it will hang plumb when it is lifted.

If it is a 4-ported cylinder, a good way will be to have a pair of broad hooks made that will look like enlarged editions of the hooks which are used to lift barrels with. The hooks must be forged heavy enough so that they will not bend. Have one put on each end of a chain that is long enough to double and more than extend clear through the length of the cylinder. Hook on to the lower ports, inside the cylinder, and cut a strong timber just long enough to force between the chains, when the hooks are put in place on opposite sides of the cylinder, then fasten the timber securely in place. This makes it impossible for the hooks to slip out.

Take a little strain on the hoist and secure the chain where it is at the height of the top of the cylinder with a rope from some of the studs. Lift the cylinder clear and see if it hangs level, if not lower it and make the necessary change. It can then be hoisted and carried over the frame head and lowered in place. As it comes down, have men stationed so as to guide it over the holes in the frame head and see that the studs enter all of the holes freely and do not rub against the threads. If there are dowel pins, enter them before the cylinder is landed as it is impossible to turn it after it is seated. Make sure that all dust is removed from the ground joint and paint it with a mixture of cylinder oil and graphite. Put the nuts on the studs and set them up solid.

Just here I want to say a few words about setting up nuts. There is no one thing done about the erecting work with as little good horse sense as this thing of screwing up nuts. I have seen many a man screw down an inch nut with a wrench that had a 2-ft. length of pipe on the handle and then as if that were not enough, he would take a heavy hammer or sledge and pound the wrench with that.

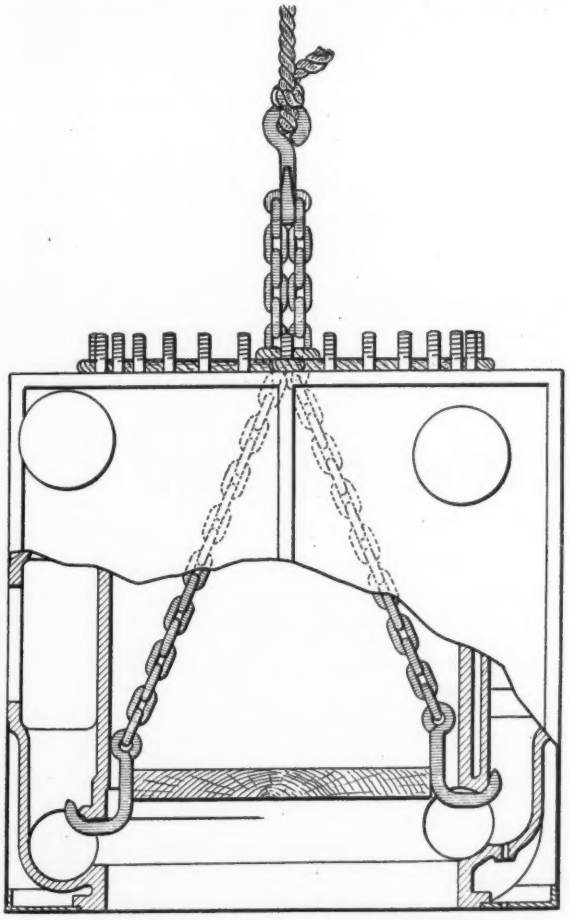
Such work is imbecile. If the nut fits the bolt as it should, the strain that a man can put on it by a steady pull on a wrench made for it is all that should be needed. Perhaps a light tap or 2 with a hand hammer on the wrench is permissible in some cases, but for all bolts of less than 1½ in. the regular wrench will supply all the force necessary in almost any case. A little ordinary intelligence in using a wrench would result in a great deal less abuse of nuts and bolts.

Lining Up Cylinders

NEXT the high-pressure cylinder will be put in place and will be handled in the same way as the low-pressure cylinder. Now, we want to know if the cyl-

inders are in line with the guides and to find out we drop a plumb line through the center of the cylinder and set it by the aid of the inside calipers, working from the top of the upper counter-bore and the stuffing box in the lower end. If we find that when the line is central at the top it is not so at the stuffing box, we shall have to loosen up the bolts that hold the frame head to the front and back columns and slip in liners enough to correct the fault.

The liners should be made of metal and cover as much surface as possible. For very thin liners, sheet brass is



METHOD OF HANDLING THE CYLINDER

good and can be had as thin as 0.01 in. or less. Tin or iron can be used if thicker liners are needed. If the work has been done properly in the shop, no correction will be necessary, nevertheless it will often be found necessary to make some adjustments to get the cylinders in perfect line.

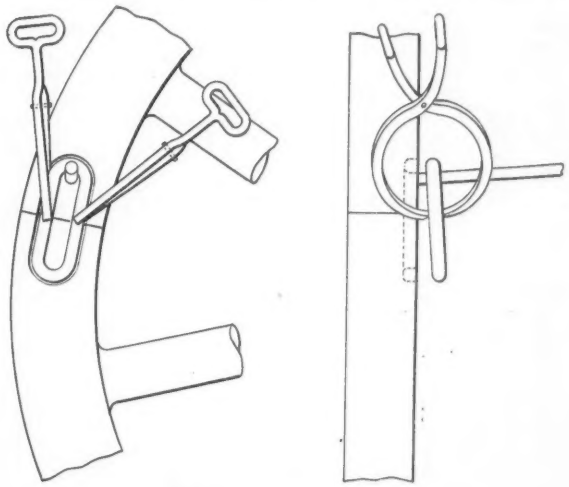
Assembling the Wheel

WE now have the engine well started and can keep quite a large gang of men at work. The only remaining large piece is the wheel and this can be put together at any time now. Have the hub cleaned and see what number of hole is at the top for the bolts that attach the arm to the hub. Find the section of the rim that corresponds and get it run in ready to pick up. There will probably be 3 bolts through the arm and these are all numbered and must be picked out and got all ready to put in place. The wheel section is hoisted and carried to the hub and forced into its place and one of the bolts driven. With a little manipulation of the crane we can make the other holes come true and then drive the bolts.

See that everything is clear of the armature and shaft, the crank pit free of obstructions that the pins might hit and unhook the crane. Probably the section of the wheel is nearly enough over the center of the shaft so that it will not move, and in this case we can hitch the crane hook under the edge of the rim where it adjoins the next section and by hoisting a little the shaft will revolve and the section will roll around into the pit. We then select the section that goes in the uppermost part of the hub and put it in the same way we did the first one.

This is continued until all the sections are in place. The third section will need to have the shaft turned so as to bring its place in the proper position and the shaft will have to be blocked there. If the blocking is placed right it can be knocked out when the section is in and the wheel will revolve enough for the fourth section to be put in.

After all the wheel sections are put into the hub and bolted, the links will have to be put into the rim. The



PLACING THE LINK

links should be numbered in the shop and the rim marked to correspond. If this has not been done, the length of each link should be measured, and the recesses in the rim likewise. If there is a difference in them the links will have to be selected for each place and marked.

The steel links will be a little short and must be heated in order to get them in place. Have a good fire made and get the links red hot through the section between the heads. A pair of ice tongs and a piece of pipe make a convenient combination to handle the hot links with. Have 2 men pick up the link by its end and have 2 others, with a piece of pipe, stand by the wheel, and when the link is brought and lifted to its place, the pipe is put under it and the tongs slipped back a little so the top end can be slid into the hole for a 1-16 in. or so. A sledge held against the top so it cannot slip out will allow the tongs to be removed and the lower end should fall into place. A few taps with the sledge will send the link home and it is allowed to cool before the wheel is disturbed.

The link on the opposite side is then put in and the work continued until all are in place. After they are cold, tap them with a hammer and if they are gripping the rim properly they will ring like bells. This is a very good test, and the tone of the link as it is struck will tell whether it is tight in the rim or not.

The links do not fill the cavities in the rim and this space is rather unsightly so we had best fill it up. A good way is to drive in waste until it is full to within about a half inch of the top and finish with Smooth On iron cement. When this has hardened and a coat of paint put on the wheel looks as if there were no joints at all. Good, careful work ought to be done on the wheel so that it will run true, as a weaving wheel is an eyesore around a plant. If the engine has a flywheel governor, like the McIntosh & Seymour engine, particular care should be exercised to have the wheel run true so that the parts of the governor will line up correctly.

There is a possibility of the sections of the wheel not coming flush on their edges when the parts are put together, and if this happens something will have to be done to true the wheel before the links are shrunk in. About all that can be done is to get some short pieces of iron that will go into the recess where the heads of the links fit and put a bolt through them so that the sections can be pulled together solid by turning up the nuts on the bolts.

The wheel is then revolved and a piece of chalk is attached to some rigid point in such a way that it will make a mark on the side of the rim where it is highest. Notice will be taken as the wheel revolves if all the sections but one run true and if this is so, the section that is out is jacked over as much as needed and the clamps tightened again so as to hold the section in place. We can defer the work of putting in the links until the engine is ready to take steam and then turn it slowly with steam.

Considerable trying will have to be done before the wheel is made to run true and when it is made so, 1 clamp at a time is removed and the link put in its place and allowed to cool before the next clamp is taken out. This is quite a job and fortunately it is not often that we shall have to do it. The only way it is possible for the wheel to be out is that when it was assembled and turned in the shop, it was sprung in assembling and as soon as the clamps were removed it resumed its normal position. From this we know that if it was sprung once it can be again and so we do not get discouraged and think that it cannot be made to run true.

When we have finished with the wheel all of the really big work is done and the remainder will require a little different kind of study in order to keep things moving to the best advantage. Our problems thus far have been how to handle heavy parts, the most economically and these problems have brought into play a knowledge of forces and the directions in which they operate. A careful study of some good work on the resolution of forces, the center of gravity and kindred subjects will be of a great deal of benefit and this knowledge will come into play in the work before us but not to so important an extent. Our next step is to assemble the valve gear, but that will have to wait for the next chapter.

VALVE DIAGRAM AND INDICATOR CARD

By J. A. Switzer

THOSE articles on the Bilgram diagram should prove to be of much interest to engineers, as they give the clearest exposition of the diagram I have ever seen in print.

One of the most interesting and valuable exercises which we give our students in the engine laboratory is the setting of slide valves and the subsequent study of valve action by means of the Bilgram diagram.

Valve Measurements and Diagram

CAREFUL measurements of the valve and valve seat having been taken, and the valve having been set first for equal lead and then for the proper amount of lead, the engine will have been put under load and the card taken.

Proceeding now with the exercise, we first make a section drawing to any convenient scale (or if possible to full size) of the valve and seat, with the valve centrally located. This drawing clearly shows the amount of steam and of exhaust lap.

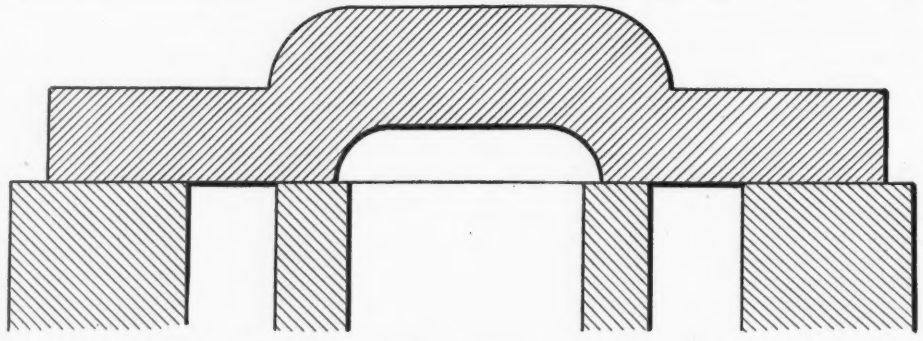


FIG. 1. FULL SIZE SECTION OF SLIDE VALVE DRAWN FROM MEASUREMENTS

It may be of interest to the readers of Practical Engineer to be shown the method of relating the Bilgram diagram of an engine to the indicator card which the engine actually gives and to what may be called the ideal card for the same engine.

To make clear this relation, it is necessary in drawing the diagram to make the diameter of the crank circle the same as the length of the indicator card. In all other respects the diagram is constructed in precisely the manner which has been so clearly laid down. Let me explain the procedure by means of an illustration from actual practice.

Indicator Cards

THEN the Bilgram diagram is constructed and below this the indicator card is placed. Now the events of the stroke being located on the diagram, their exact location upon the indicator card is obtained by projecting them downward by means of the dotted lines shown in Fig. 2.

Finally over the actual indicator card the ideal

card is constructed. In an ideal engine neither wire-drawing nor cylinder condensation would occur; expansion and compression would be adiabatic, and cut-off and release would be instantaneous operations. Translating these statements into terms of the indicator card we note that the steam line must be straight and horizontal to the point of cutoff, the expansion line a hyperbolic curve from point of cutoff to point of release, and the compression line a hyperbolic curve from point of compression to point of admission. The

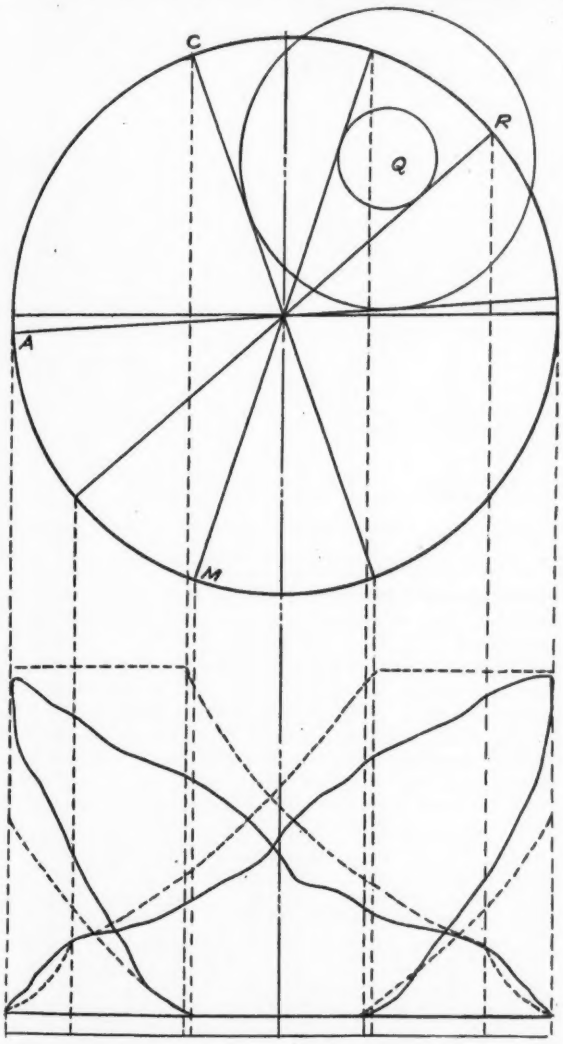


FIG. 2. VALVE DIAGRAM AND ITS RELATION TO THE INDICATOR CARDS, ACTUAL AND IDEAL

ideal card then is drawn conforming to these conditions and with pressure obtained by measurement upon the actual indicator card, and the location of the events of the stroke gotten by projection downward from the Bilgram diagram.

To be more explicit, the height of the steam line above the atmospheric line in the ideal card is made the same as the height of the beginning of the steam line in the actual card; the height of the point of release in the ideal the same as in the actual, etc.; while the points of cutoff, release, compression and admission are precisely located by continuing the dotted projection lines downward from the Bilgrim diagram.

Ordinarily the purpose which this study is intended to serve can be fulfilled by drawing the expansion and compression lines free-hand, as was done in the case here illustrated; although if it be desired to locate them with mathematical precision, the method of doing so is not difficult. The comparison of the actual indicator card with the ideal cannot fail to be full of interest to the student of steam engineering. The ratio of the area of the former to that of the latter is approximately the same as the ratio of the energy which the engine actually utilizes to that which is theoretically available for use between the given limits of pressure. Further than this, a comparison of the 2 cards serves to emphasize any existing defects either of the valve setting or of the engine design itself.

Among the readers of the Practical Engineer there must be many men who have slide-valve engines under their charge to whom such a study of their own engines would be interesting and instructive; and it is in the hope of serving these men that the article is written.

OHIO FIREMEN'S LICENSE

IN November, 1909, an opinion was rendered by the attorney general of the state of Ohio that the examiner of engineers was without power to grant a license, for the operation of boilers only. The law was: That a man to operate a boiler must have an engineer's license, and be authorized to operate both boiler and engine. In order to remedy this difficulty a new bill has just been passed by the Ohio Legislature which provides as follows:

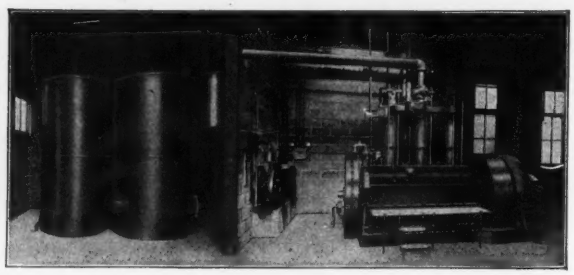
In order to operate a boiler of more than 30 hp.—a horsepower here meaning 12 sq. ft. of water heating surface—a man must be duly licensed as a fireman, unless the boiler is in charge of a duly licensed engineer. The examination for fireman is on the construction and operation of steam boilers, steam pumps and hydraulics, and is in charge of the examiner of engineers for each district. If found proficient, the fireman is given a license which continues in force for 1 yr. and may be renewed annually without further examination. License may be revoked upon charges by the district examiner, if the holder of the license is shown to be unfit to operate or have charge of the boiler.

Fee for examination is $2, and for renewal $2, all fees being paid to the district examiner, and into the state treasury. The penalty for violation of this act or for operating a boiler without license is not less than $10 nor more than $100.

With this bill goes another one which changes the power in regard to the engineers' license, the state being divided into 10 districts, each of which has a district examiner, and each examiner must be a competent and practical steam engineer, his appointment being for 3 yr. A license is required for operation of a stationary steam boiler or engine of more than 30 hp., and subjects entering into the examination are the construction and operation of steam boilers, steam engines and pumps, hydraulics, and the applicants must pass the examination under oath, made necessary by the rules and regulations. Other provisions of the engineers' license law are the same as heretofore.

By the ruling of the attorney general and the passage of this new bill, the present firemen's licenses are made illegal, and it becomes necessary to re-examine those firemen who are in charge of a boiler, but not a steam engine, under the old practice of the district examiner's office. Chief Examiner Haswell is therefore making arrangements to hold examinations as rapidly as possible so that those men in charge of boiler operation can qualify according to the new law as firemen.

Gas Producers

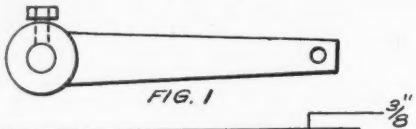


And Engines

GAS ENGINE MIXING CONTROL

By W. C. Whetstone

I AM running a Westinghouse horizontal gas engine 23½ by 33 in., making 150 r. m. p., using producer gas, which, at times, necessitated a great deal of changing of the air valves in order to get the proper mixture. These valves are separate and being under the gas valves on manifold pipe require constant moving around to get them changed back and forth as they are locked with stud and nut to the manifold pipe.



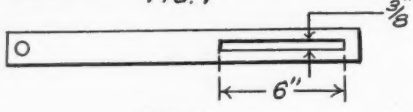


FIG. 2

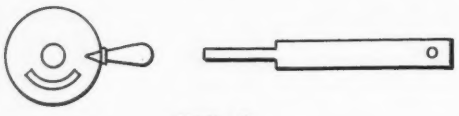


FIG. 3

FIG. 4

FIG. 1. AIR-VALVE LEVER
FIG. 2. INTERMEDIATE LEVER
FIG. 3. HANDLE ON AIR VALVE
FIG. 4. BOLT USED IN SLOTTED LEVER

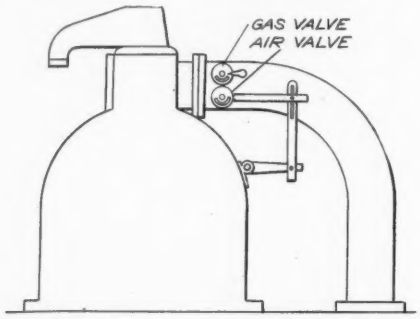


FIG. 5. VIEW FROM END OF ENGINE SHOWING VALVE CONTROL

In order to avoid this trouble of changing separately I rigged up the device shown in the illustration. On the gas manifold pipe are 2 valves, one above the other. Under the manifold is a tube running the length of engine, which is part of indicator reducing motion; taking this tube out, I substituted a ¾-in. steel rod, and making 4 levers as shown in Fig. 1, I slipped them on and secured them with set screws under each valve.

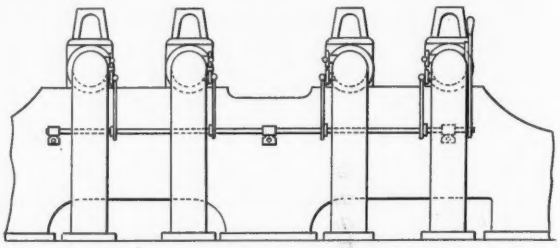


FIG. 6. SIDE VIEW OF ENGINE WITH AIR-VALVE CONTROL

Then I made 4 levers with a slot at 1 end ⅜ by 6 in. and bolted these, as shown in Fig. 5, to the levers in the shaft.

On the air valves short handles are screwed into the disk and act as set screws on valve stems; these are shown in Fig. 3. Unscrewing these I substituted a lever in place of handle as shown. Fig. 4 is a ½-in. bolt, filed flat to work in the slotted lever so it will not bind.

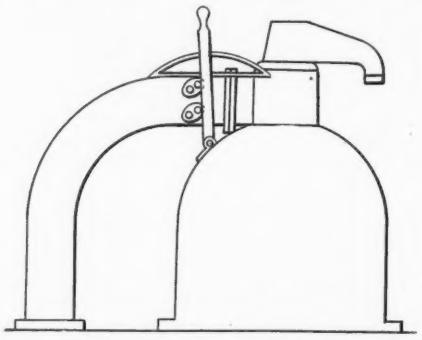


FIG. 7. QUADRANT AND LEVER FOR ADJUSTING VALVES

On the forward end of the engine and bolted on the back of gas valve on manifold, is a quadrant and lever by which all 4 valves are worked simultaneously, thereby regulating the mixture.

The slot in the intermediate lever permits any valve to be adjusted separately. The ¾-in. steel rod can be placed above the indicator rod if preferred without interfering with it.

Anger and worry not only dwarf and depress, but sometimes kill.—Fletcher.

GAS ENGINE TROUBLES

SOME of the troubles that the operator of a gas or gasoline engine is apt to encounter have been put in the form of a troubleman's report and printed in Gas Review. The following, which is an abstract of one of these articles, deals with troubles experienced in starting balky engines.

Engine stopped of its own accord while running. Owner cranked it but it would not go. He looked it over and over again but no fault could he find. His neighbors told him that such spells were natural with all gasoline engines. When we arrived, he and his family and the neighbors promptly gathered around the "brute" to learn what could have caused "her contrariness." Some of them remarked that they did not believe that anyone could start that engine. The owner was pretty sure that the trouble was due to leaky compression, because by holding the charge in a compressed position he could hear a slight escape of air.

We jerked the flywheel backwards and it promptly sprang back, showing that the engine had ample compression to start. We examined the intake valve; it was not stuck. We ascertained that the needle valve opening on the carburetor was not clogged, so the trouble was not with the engine's failing to get gasoline, or with the compression.

Testing Ignition

THE trouble must be with the spark. We then put on the switch and tested for a spark with a metal wrench by holding it in contact with the insulated electrode on the igniter and the metal of the engine, and on breaking the contact it gave no spark. This indicated that there was no current or else that the sparker points were in contact all the time.

On moving the snapper tongue on the igniter we could hear the points come together, so the igniter points were not in constant contact and the movable electrode was not stuck. The trouble must be either with the battery or with the electrical contacts between the battery and the engine. On examination, all the connection nuts and the switch were found to be tight. One other contact needed to be looked to and that was the circuit breaker. To the eye the circuit breaker seemed to be O. K., but on springing or pushing the contacts together firmly and trying again with the metal wrench for a spark, a fine spark was obtained on breaking the contact.

Hence the cause of all this trouble was due to faulty contact at the circuit breaker. The remedy was to bend one of the circuit breaker brass contacts so that they went into firm contact when the exhaust valve was in a closed position.

In this engine the circuit breaker electrodes made a sliding contact. The constant sliding of one electrode on the other wore the metal away until they failed to touch. When examining for sparking troubles, don't overlook the connection at the circuit breakers. It is equally as important as any other connection.

As a result of this treatment and a 15 minutes' lecture to the owner on "What makes a gasoline engine run," the engine is still going and will most likely keep going. What we need most for the good of the gas engine is better general knowledge of the elementary principles on which it operates.

Battery Run Down

NO spark. All connections good. Wired properly. Water oozing out of 3 of the dry cells. Snow on top of other 2 cells. Much snow in the battery box due to drifting under a loosely fitting battery box cover. Engine exposed to weather. Ammeter showed the cells to be dead.

The cause of the dead cells was due to the snow (a good electrical conductor) short circuiting the cells; in other words, the snow connected the carbon battery post to the zinc cup edges, thereby running them down in a short time. The water oozing out of them was a sure sign that they had been short circuited. When a dry battery is discharged quickly, water runs down its sides and wets the paper cover and sometimes stands in little puddles on top of the cell. This water does not freeze, due to the chloride in it which makes it anti-freezing. On a freezing day this is a sure sign that the unfrozen water on the cells came from them and that it did not rain in or get there otherwise.

A new set of cells is the only remedy.

A good spark and engine starting nicely was the result of putting in a new battery.

Air Supply

IN another plant the engine was stationary, vertical, 4-cycle with a gasoline pump feed. No priming cock on the engine. Priming was done by lifting an air throttle damper, thereby making the engine suck in its priming charge through the carburetor.

By cranking very fast it would start and when started would run perfectly. It was notoriously hard to get the first explosion. When examining this engine we tried the effect of placing one hand over the opening in the air intake pipe and found that when we did this the engine would start nicely with our hand excluding some of the air, but when the air damper only was lifted the engine would not go except after prolonged cranking. The trouble was thus proven to be in the air damper.

On taking out the air damper, 4 holes about ¼ in. in diameter were found to be bored through the circular disk that was intended practically to close the air pipe.

We plugged up these 4 holes with lead so as to exclude more of the air when the damper was raised in starting position. This was the nicest starting engine we ever saw after this treatment..

It is sometimes as necessary to look after the air supply as it is the gasoline supply. Excluding some of the air makes harder suction on the gasoline and makes the engine take a richer mixture, which sometimes aids in starting.

Flooded Cylinder

ON another occasion every part of an engine was found to be in good running order on examination and we suggested to the operator the possibility of his engine's being flooded with gasoline. He said that he did not think so and proceeded to examine to satisfy himself that it was not flooded. He caught hold of the flywheel and turned it over several times, holding his ear near the cylinder. He pronounced the engine not flooded.

We wondered what new method this was. It was certainly new to us and we promptly asked him how he knew the engine was not flooded. His answer was to the effect that he could not hear the gasoline "slosh." Is there a man who reads this journal who thinks that it requires enough gasoline in the cylinder to hear it splash on moving the piston to cause a flooded condition of the engine?

That engine was flooded badly, but it did not have enough gasoline in it to hear it splash.

We shut off the feed by closing the needle valve, opened the air damper wide so as to supply air with which to burn the gasoline, and put on the battery switch and then cranked her over from twenty to thirty times, when it started to igniting and exhausting a cloud of black smoke. After eight or ten ignitions she began to miss fire, whereupon the needle valve was opened to give more gasoline. The engine then worked like a top.

We once visited a similar case in which the owner gave as his reason for knowing the engine was not flooded, "that gasoline did not run out of the igniter opening when he took out his igniter and introduced a paddle" and because gasoline did not wet the paddle he was sure the engine was not flooded. Who's to blame for such ignorance? Is there any wonder that all gasoline engines do not always run?

You can't tell by any of these methods if an engine is flooded. A tablespoonful of gasoline may be sufficient to prevent ignition. If you suspect too much gasoline, the quickest remedy is to work it out through the exhaust by opening the air pipe and closing the gasoline needle valve. In very cold weather a very good remedy is to take out the igniter, hold open the exhaust valve, and set the gasoline in the cylinder on fire with a match.

Be careful not to get in front of the opening when the match is applied, for a blaze of fire 3 ft. long is very apt to come out, after which the surplus gasoline will burn slowly like so much kerosene until it is all burned out of the cylinder. The reason for holding open the exhaust valve is to give a circulation of air through the cylinder so that the flame will not smother. This method has the advantage of warming the cylinder. When the surplus fuel burns, put the igniter back in place and start the engine in the usual way.

ALCOHOL VS. GASOLINE

IN a bulletin on Commercial Deductions from Comparisons of Gasoline and Alcohol Tests on Internal-Combustion Engines issued by the United States Geological Survey, Robert M. Strong gives the results of tests which were conducted under the technical direction of R. H. Fernald, engineer in charge of the producer-gas section of the technologic branch, at the fuel testing plant in St. Louis, Mo., and at Norfolk, Va. The tests dealt primarily with gasoline, forming part of the investigation of mineral fuels provided for by acts of Congress. To determine the relative economy and efficiency of gasoline it was compared with denatured alcohol. When the series of tests was started, it was found that it took from 1.5 to 2 times as much alcohol as gasoline to produce a given power. With special alcohol engines, entirely suited to the use of alcohol, the latter fuel has been made to do as much work, gallon for gallon, as the gasoline.

On this point, the bulletin states: "By using alcohol in an alcohol engine with a high degree of compression (about 180 lb. a sq. in. above atmospheric pressure—much higher than can be used for gasoline on account of preignition from the high temperature produced by compression) the fuel consumption rate in gallons a horsepower an hour can be reduced to practically the same as the rate of consumption of gasoline for a gasoline engine of the same size and speed. The indications are that this possible 1 to 1 fuel consumption, ratio by volume, for gasoline and alcohol engines, will hold true for any size or speed, if the cylinder dimensions and revolutions per minute of the 2 engines are the same."

Some of the more important results and conclusions stated in this bulletin are as follows:

The low heating value of completely denatured alcohol will average 10,500 B. t. u. per pound, or 71,900 B. t. u. per gallon.

The low heating value of 0.71 to 0.73 specific gravity gasoline will average 19,200 B. t. u. per pound, or 115,800 B. t. u. per gallon.

The low heating value of a pound of alcohol is approximately 0.6 the low heating value of a pound of gasoline. A pound of gasoline requires approximately twice as much weight of air for complete combustion as a pound of alcohol.

A gasoline engine having a compression pressure of 70 lb. but otherwise as well suited to the economical use of denatured alcohol as gasoline, will, when using alcohol, have an available horsepower about 10 per cent greater than when using gasoline.

When the fuels for which they are designed are used to equal advantage, the maximum available horsepower of an alcohol engine having a compression pressure of 180 lb. is about 30 per cent greater than that of a gasoline engine having a compression pressure of 70 lb., but of the same size in respect to cylinder diameter, stroke and speed.

Alcohol diluted with water in any proportion, from denatured alcohol, which contains about 10 per cent of water, to mixtures containing about as much water as denatured alcohol can be used in gasoline and alcohol engines if they are properly equipped and adjusted.

When used in an engine having a constant degree of compression, the amount of pure alcohol required for any given load increases and the maximum available horsepower of the engine decreases with a diminution in the percentage of pure alcohol in the diluted alcohol supplied. The rate of increase and decrease respectively is such, however, that the use of 80 per cent alcohol instead of 90 per cent, or denatured alcohol, has but little effect upon the performance of the engine; so that if 80 per cent alcohol can be had for 15 per cent less cost than 90 per cent alcohol and could be sold without tax when denatured, it would be more economical to use the 80 per cent alcohol.

In regard to general cleanliness, such as absence of smoke and disagreeable odors, alcohol has many advantages over gasoline or kerosene as a fuel. The exhaust from an alcohol engine is never clouded with a black or grayish smoke, as is the exhaust of a gasoline or kerosene engine when the combustion of the fuel is incomplete, and, it is seldom, if ever, clouded with a bluish smoke when a cylinder oil of too low a fire test is used or an excessive amount supplied, as is so often the case with a gasoline engine. The odors of denatured alcohol and the exhaust gases from an alcohol engine are also not likely to be as obnoxious as the odor of gasoline and its products of combustion.

The price of denatured alcohol is greater than the price of gasoline, and the quantity of denatured alcohol consumed by an alcohol engine as ordinarily constructed and operated is in general relatively greater than the quantity of gasoline consumed by a gasoline engine of the same type. Considerable attention is being given to the development of processes for the manufacture of alcohol from cheap raw materials which are generally available, and it seems reasonable to expect that the price of denatured alcohol will eventually become as low or lower than the price of gasoline, especially if the price of gasoline advances. It also seems reasonable to expect a greater general improvement in alcohol engines than in gasoline engines.

Denatured alcohol will, however, probably not be used for power purposes to any great extent until its price and the price of gasoline become equal and the equality of gasoline and alcohol engines in respect to ability for service required and quantity of fuel consumed per brake horsepower, which has been demonstrated to be possible, becomes more generally realized.

A further general development in the design and construction of engines that use kerosene, or cheaper distillates, and the crude petroleums may be reasonably expected and may delay the extensive use of denatured alcohol for some time to come, but as yet comparatively few data pertaining to this phase of the general investigation are available.

LONDON LETTER

OPERATORS' MISTAKES

By W. A. Tookey

MANUFACTURERS of internal combustion engines have emphasized by constant reiteration the claim that the attendance necessary is such as to be within the capacity of any person of average intelligence without previous experience with machinery. This is, of course, to some extent a just claim, but it must not be forgotten that, to obtain continuous and reliable operation, it is imperative for the attendant to pay careful heed to the instructions given, either in writing or preferably by practical demonstration, and by thus becoming competent he can no longer be looked upon as unskilled.

During the last few weeks the writer has been informed of a case where an attendant—a gardener employed upon a country estate—failed to remember the instructions he had received with regard to stopping an engine of which he had charge. He found no difficulty in starting up and in keeping the engine going, but he was completely at sea as to the manner in which it could be brought to rest. In this dilemma he braked the flywheel with his spade and then carefully passed the latter through the spokes to prevent it restarting by its own volition while he went home. The makers were wired for and were successful in stimulating his defective memory.

There was perhaps a little excuse for him. It was a hot-air engine and he did not know how to "get the air out of it." It did not occur to him to turn off the gas flame under the cylinder until after he had "spoked" the wheel. Then he thought the lighted burner was a waste of gas and promptly extinguished it.

Board of Trade Rules

SOME idea as to the requisite qualifications for those placed in charge of oil engines may be gleaned from a recent publication by the Marine department of the British Board of Trade, addressed to examiners and candidates for second-class certificates of competency as engineers of vessels propelled by this power.

No candidate must be less than 21 years of age. He must prove 6 months' experience with oil engines at sea and, in addition, either (a) 4 years' experience at the making or repairing of machinery, of which period 6 months must have been spent at making or repairing oil engines, or (b) 3.5 years' experience on shore. Alternative service to the above may be considered, but it is essential that the candidate should have experience with oil engines and should have spent at least 6 months at sea in the engine room of a sea-going vessel.

It is prescribed that the candidate must write a legible hand and have a good knowledge of arithmetic up to and including vulgar and decimal fractions and square root. He must also understand the application of these and other rules to problems relating to spring and lever-loaded relief valves, and be able to answer questions about the relative speeds of a vessel at different revolutions of the engine shaft, the capacity of oil tanks, etc.

He must also be able to give a clear explanation of the principle on which an oil engine works and to show, by means of illustrated sketches, that he understands the construction of those in general use. He must show that he understands the mechanism of the starting and reversing arrangement and that he is competent to deal with defects which may lead to failure in the prompt handling or reversing of the engine. He must have sufficient mechanical ability to be able to overhaul an oil engine; to adjust its working parts; to reinstate all details in good working condition; to manipulate an oil engine when under way by starting, stopping, reversing or slowing down.

He must understand what is meant by flash point; and have a knowledge of the explosive properties of the oil generally used in oil engines when exposed to the open air; recognize the danger of exposing any vapor from the oil to a light; or of allowing any leak from the oil tanks, particularly into the vessel's bilges. He must also understand the purpose of the provision of wire gauze diaphragms when placed in pipes and connections to oil tanks and the manner in which prevention of explosion or ignition of oil vapor is secured by such means. He must be able to take the necessary precautions to guard against the escape of inflammable vapor from the vaporiser when the engines are stopped.

Further he must be able to explain the principle of working and construction of a dynamo and the construction and arrangement of primary and secondary batteries and induction coils, so far as is necessary for the efficient management of an oil engine installation.

Experience but Not Knowledge

THE somewhat extensive knowledge that is required in the above stipulations is not essential to those attendants who are placed in charge of oil engines on land. There is little doubt, however, that, speaking generally, the instruction they receive or knowledge they acquire is somewhat inadequate. One man, with whom the writer came in contact recently, had been in charge of a gas engine for over 19 years. This was superseded by a larger and up-to-date engine and the old man was delighted to find that the new arrival had a gas pipe and an air pipe and an exhaust pipe, just like "my engine," as he called it.

He was rather dubious about the electric igniter and it was interesting to notice how delicately he pressed the wire into the binding post when there was no chance of getting a shock. His love for "my old engine," however, still flourished and he had evidently been talking things over with some of his friends who were also drivers of gas engines in neighboring factories, for upon the occasion of the writer's next visit the proprietor of the factory said that there was a proposal to spend a few pounds upon the abandoned engine so that it would give off as much power as the new one.

It appeared that the project was to put another flywheel on the other end of the crankshaft and then—more power would be instantly available! The proposal was made by the driver in all seriousness and only when asked why stop at one more flywheel, if such splendid results could be secured so readily, did it begin to dawn upon him that the era of perpetual motion is yet in the future.

Explosion Causes

A SOMEWHAT similar instance of inadequate knowledge but one which had very grave consequences occurred in connection with a petrol (gasoline) air gas making apparatus supplied to the owner of a bungalow for the purpose of illumination. In this case the fault was not with the attendant but with the designer. A hot-air engine was fitted to drive a small blower which forced air into a vessel provided with a dome or bell to rise and fall in a water tank as in an ordinary gas holder. The aerometer was the uppermost compartment

in the principal portion of the apparatus. At its base was the carbureter and at mid-height was placed the gasoline reservoir.

Air from the bell was forced to the carbureter under pressure of about 2 in., through either or both of 2 branches. One branch was below the float-controlled level of the gasoline in the carbureter and the second was a few inches above the surface. The latter was provided with a cock so that by proper adjustment the required richness of gas could be secured according to the prevailing atmospheric conditions of temperature, etc.

One hot day during August, 1909, the plant had been standing idle since the previous evening. A match was struck to light the burner under the hot air engine. Immediately the shed in which the apparatus was fixed became filled with flame, resulting in severe injuries to 3 persons in its vicinity. An action at law followed in which damages were obtained from the makers for breach of warranty because in all catalogues and literature published by them emphasis had been laid upon the absolute safety of the plant and nonexplosibility of the gas it produced.

The writer examined the apparatus for the purpose of giving evidence at the trial and found that there was a direct and open communication between the carbureter below and aerometer above. The hot direct rays of the midsummer sun had undoubtedly caused the gasoline to give off vapor which becoming diffused throughout the whole apparatus and being exposed for many hours to the influence of comparatively high temperature, eventually exerted a pressure exceeding 4 in. of water, thus breaking through the seal around the bell, and permitting the vapor to escape into the shed.

Experiment showed that by gradually increasing the temperature of gasoline in a sealed vessel from 70 to 73.6 deg. F. the vapor pressure rose from zero to 5 in. of water. The influence of temperature upon the volatility of gasoline is widely recognized amongst those daily concerned in its use but this fact is not usually brought to the knowledge of a gas plant attendant.

In another case a gas producer had been used to serve an engine for the generation of electricity. The battery having been fully charged the plant was shut down in the usual course, but for some special purpose orders were given to the attendant to start up again within a few hours. He was in the habit of using a small quantity of gasoline when kindling the fire in the generator and followed his usual practice. Upon the application of a match a violent explosion ensued resulting in severe injuries to the unfortunate and only partially instructed man.

Wreckage

ONE other accident may be mentioned in illustration of the need for adequate instruction to gas power engineers. A 2-cylinder gas engine, twin type, was erected in a factory a few months ago. For some reason it was desired to use 1 cylinder only, temporarily. The connecting rod of the second cylinder was uncoupled from the crankpin and the piston forced back to let the crank revolve freely. While the other cylinder was in operation, the exhaust pipes were in communication and the valve movements occurred as if the second cylinder was in actual operation. After some hours an explosion took place in the idle cylinder, forcing the piston out and bringing the connecting rod in the way of the revolving crank. The wreckage resulting can be better imagined than described.

The right course to have adopted would have been to remove the air and exhaust valve levers. Unfortunately the probability of an accident occurring had not been realized by the operator and no warning had been given of any risk by the manufacturers of the engine, nor instructions imparted as to the proper steps to be taken to prevent such serious damage.

TRAINS

A RAILWAY train, the most familiar thing in the world, is the most romantic. It is the profound and inexhaustible source of joy to the uncounted generations of children that step into one another's little shoes and keep the faculty of rapture alive on earth. It is a lure and a mystery and an embodiment of the invisible and unspeakable to the poet. He will pause on a windy hilltop, call down his gaze from the unplumbed blue overhead to watch the noon mail traverse the bit of clear sky-line on the opposite ridge. The train roars afar off, like the surf on sand; comes fast into view; crosses its allotted space; and is gone.

It passes slowly enough as the watch ticks, yet urgent and low and long, over there, like a running greyhound or a racing horse, it conveys the impression of matchless velocity. It goes like a hunted thing in a dream, that makes desperate haste and can barely creep by the lagging landmarks. It was not, it was there, it was gone. It came out of the unknown infinite, and passed again into the infinite unknown. It is a daily recurrent symbol of life, a moment between 2 eternities.

At night the lonely hooting of the engine in the darkness draws a poet to his balcony to watch the regular lights flash by far above on the high horizon, and see the sudden flare, ruddy against the level trail of smoke, vibrating dimly outward, through the thick black air, even to the rim of things. Under all the sky, in thick weathers, in certain aspects, the glow seems to mingle with the gray of night and change the colors of it—to suffuse it all with impalpable gold-dust; the tawny plume of smoke, the golden patches of the windows, the hurrying silhouette of dull black on luminous black, are less like anything plastic than like the strange solutions and bewildering progressions of modern music. They have the same air of suggesting what experience has not known, of stirring memories which must reach to the other side of birth—antenatal dreams, intangible expectations.—Harper's Weekly.

ROPE SHEAVES

FOR ROPE drives the width of sheaves is shown by the Plymouth Cordage Co. in the case of a drive by 4500 ft. a minute rim speed, transmitting 200 hp. Five 1¾-in. ropes would be used, having a sheave of 14-in. face, allowing supporting bearings to be placed near together which is an important advantage, particularly in drives of large capacity.

Steadiness of speed in the driving shaft of a rope system is an essential feature obtained. Any slight variation in engine speed or in load on the driven shaft seems to be absorbed without producing perceptible effect. This point is especially advantageous in an electric light plant, where any unevenness in speed is at once noticeable on the lamps of the various circuits.

A CHARACTER is a man who knows what he wants; who does not allow his temper and moods to govern him, but acts on firm principles.—Treu.

MODERN DEVELOPMENTS IN REFRIGERATION

APPLICATION TO COMPESSED AIR APPARATUS

By E. P. Rogers

INCREASED ACTIVITY IN THE application of mechanical refrigeration to other fields than that of cold storage and ice production is a matter of much interest and satisfaction to refrigerating engineers and manufacturers. The extent to which this development has progressed and the possible limitations of future development are matters of extreme interest. The refrigerating machine to-day has a range of applicability extending from the cooling of a photographic dark room to the elimination of moisture in iron furnace blast, and its extension into other more remote fields, with an increased efficiency in their processes, is not only among the possibilities of the near future but is extremely probable.

Drying Air for Blast Furnace

SUCCESSFUL application of a refrigerating machine to the drying of air for the blast in iron furnace operation and its remarkable and unexpected efficiency in this field has opened many new avenues for future progress. In order to understand this more thoroughly we will review the facts in this latter development. In one particular case over 250 tons of refrigeration was produced per day. The furnace produced, before the application of refrigeration, 350 tons of iron with a consumption of about 1 ton of coke to a ton of output. With the refrigeration used for drying the air this output was increased to 450 tons a day with a coke consumption of 1,700 lb. to a ton of output. Further, air was required in reduced amount in the ratio of 40 to 34 and the indicated horsepower of the blower was reduced from 2,700 to 2,000.

This saving of horsepower was sufficient to run the refrigerating machinery with a large saving in addition, so that the only factors necessary to consider in the process were first cost and maintenance. That this did not balance the increased output at the diminished cost but left a large margin is, of course, a foregone conclusion.

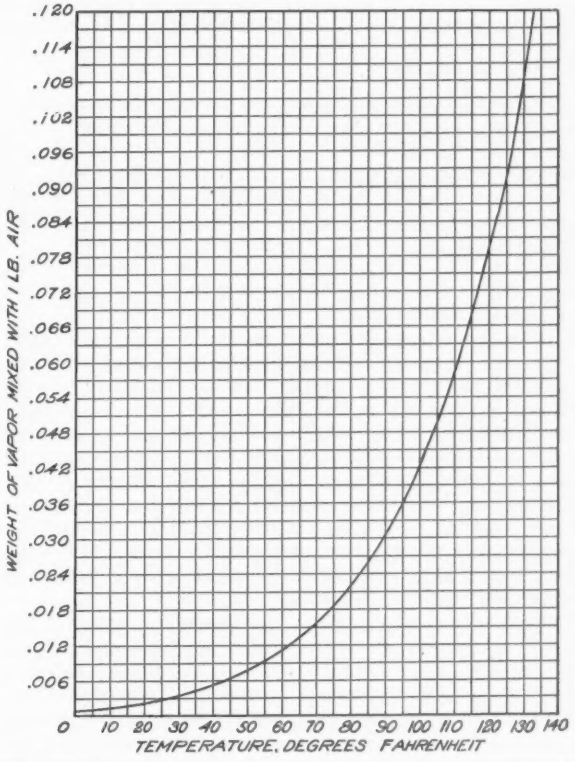
This practical development, as has been said, opens the way for many future applications. The removal of moisture and impurities from illuminating and fuel gas by this method presents a possibility only slightly less attractive, with a wide range of utilization. The object of this article is to consider its future development in the field of compressed air alone, as this seems to offer even greater opportunities for increased efficiency than the illustration given.

Application of Compressed Air

COMPRESSED air is used in large quantities as an energy reservoir and for the transmission of power for considerable distances. Its range in applicability would be much extended if the efficiency of the compressor could be increased. The ordinary reciprocating compressor is an extremely inefficient machine, practically 40 per cent of the indicated horsepower going into friction losses; and when it is considered that air compression is practically adiabatic, and that speed limitations are absolutely essential on account of heating effects, and that the greatest possible initial pressure is limited to that of the atmosphere, this statement may easily be accepted as true. The application of compressed air under efficient productive conditions would become so extended that large central power plants instead of existing occasionally would become a recognized factor in every community.

Increasing Efficiency of Air Compressor

UTILIZATION of compressed air is rendered more efficient by means of the reheater which, in the simplest form, consists merely of a heating device inserted in the air pipe just in front of its point of utilization. This heating of the air results in increased efficiency with small increased cost, as the reheater is often



RELATION OF TEMPERATURE TO MOISTURE CONTAINED IN AIR

simply an oil or gas burner burning directly into the current of compressed air.

The increased efficiency is the result of a diminution in air consumption rather than an increased pressure. To increase pressure by this means is extremely difficult in practical operation owing to the necessity of isolating small quantities of air. The valve mechanism is difficult and unsatisfactory. The practical result, however, is that the air heated at constant pressure, diminishes in density with diminution in pressure, hence the amount that enters the cylinder on each stroke in power production is much diminished.

This process is analogous to the reheating effect in ammonia compression. The ammonia gas enters the compressor and is immediately heated by contact with the hot walls of the cylinder which are the result of the previous compression. The result of this heating is not an increase in pressure of the ammonia gas but a diminution in density. Considerable less gas enters the cylinder

at this pressure on account of the diminished density and the capacity of the machine for refrigeration is reduced.

This is known as the reheating effect in ammonia compression and one of the attempts at its elimination has resulted in the process known as wet compression, whereby liquid ammonia is injected into the cylinder and cools off the walls, thus allowing the density and pressure of the incoming gas to remain constant.

Cooling Air During Compression

FURTHER, in compression of air the process is so extremely wasteful as a result of the adiabatic compression that 3-stage compressors are the rule rather than the exception when efficiency is at all considered. The gas leaving 1 cylinder is cooled by running water before it enters the next and the same process is repeated between the second and third. The result is an increased efficiency, of course, since the compression is carried on at a lower temperature and much unnecessary work which would result from compression at the higher temperature is eliminated.

Now this cooling of the air in the cylinder and between stages could be accomplished much more efficiently by refrigeration. Further, the fore-cooling of the air before entrance to the compressor would be precisely analogous to the reheating after compression for more efficient utilization. The installation of the refrigerating plant to fore-cool the air supply of the compressor would result, not in an increased pressure, but in an increased density of the entering air at the pressure of the atmosphere.

This would result in an enormous increase in capacity of the compressor since it would be equivalent to an increase in the initial pressure in its action. Further, the compression would be carried on at a much lower temperature between the initial and final pressures and hence much less work would be required in compression itself, even if accomplished adiabatically. Further, the utilization of cold brine as a water jacket for the compressor would eliminate to a much greater extent the evil resulting from the adiabatic compression and if this temperature is kept sufficiently low the process would be practically isothermal.

Thus the saving in every department of compression would be enormous. The steam consumption would be less, the capacity of the compressor greater, and the work done more efficiently. Of course, the installation would require the further utilization of an ammonia compressor, or if an absorption machine were used the exhaust steam from the air compressor could operate this nicely.

If an ammonia compressor were used, however, it would be simply a comparison of the relative efficiency of the compression of ammonia to the increased efficiency of the compression of air. That there would be a distinct gain, however, is beyond question. Ammonia compression is much more efficient than air compression. The gas enters at a high pressure and is in reality a vapor and capable of easy condensation even in the compressor itself.

Not 1 engineer in 20 would have recognized offhand the remarkable possibility in increased efficiency available in iron furnace operation. The same statement holds in regard to this application. The conditions are such that it is extremely desirable that some such plant be installed in order that a test could be made. The possibilities of profit resulting from the application of refrigeration as outlined are much superior to many of the developments now attempted by various industries in similar fields.

COAL HANDLING IN A PEORIA PLANT

REDUCING the cost of labor and minimizing the handling of materials in power plants is becoming more necessary every day and engineers situated in every part of this country are constantly on the alert to adopt the simplest and most practical methods for keeping down the operating costs.

Unusual conditions prevailing at the power house of the Peoria Gas & Electric Co., a corporation operating over 4100 hp. of boilers supplying the light and power at Peoria, Ill., necessitated a special type of mechanical equipment for conveying the coal directly from the cars to the fires under the boilers and handling the ash from the ash pits.

Accompanying illustrations show how this is accomplished, and we describe briefly the distinctive features about this mechanical equipment, which was

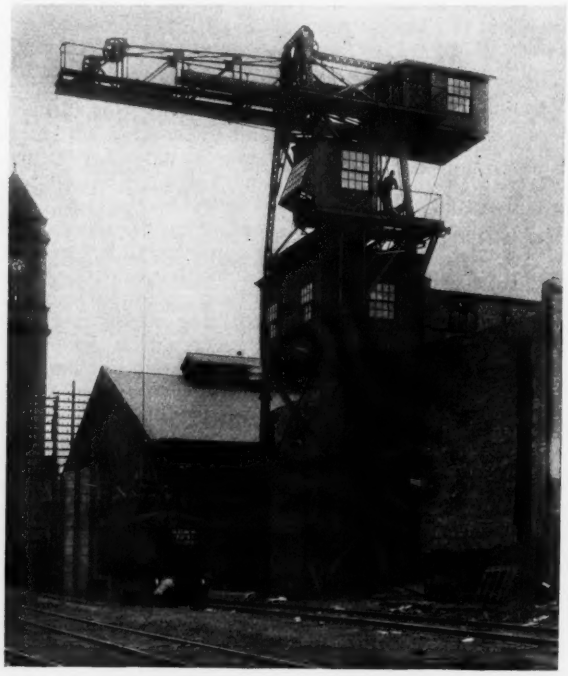


FIG. 2. GRAB BUCKET AND HOPPER ON THE HOISTING TOWER

designed to handle 50 tons of either coal or ash an hour, but as a matter of fact, is frequently handling double that tonnage.

Fuel used is run of mine coal, which is delivered alongside the plant in 30-ton railway cars. Figure 1 shows a plan and elevation of the entire power house and with the equipment in place; it will be seen that the cars may be either dumped into the track pit or unloaded direct from the car by the grab bucket, which is operated by cable and electrically driven double drum hoist situated on the cantilever tower, as will be seen in photograph Fig. 2.

In the tower is a receiving hopper where the coal is dumped from the bucket to a 2-roll crusher, electrically driven. This is accomplished by means of a reciprocating plate feeder, equipped with a perforated bottom, which allows the fine coal to by-pass around the crusher, delivering only the lump coal to the crusher

rolls. The coal passing through the rolls is delivered to a belt conveyer, which deposits the crushed coal into the storage bunkers by means of a traveling tripper. The bunkers having a capacity of over 750 tons coal storage, are so constructed that they feed the coal direct to the automatic stokers by gravity.

Figure 3 shows a photograph of the belt conveyer house above the bunkers. The conveyer is 225 ft. between centers and is 20 in. wide and is 6 ply Jeffrey Standard canvas belting. The top strand of this belt is carried on a pulley troughing idler, the return strands being carried on 2-pulley straight face idlers. This conveying belt is equipped with an automatic, self propelling and self reversing tripper provided with a brush for cleaning the belt and also 2-way discharge spout for distributing the coal evenly along the storage bunker.

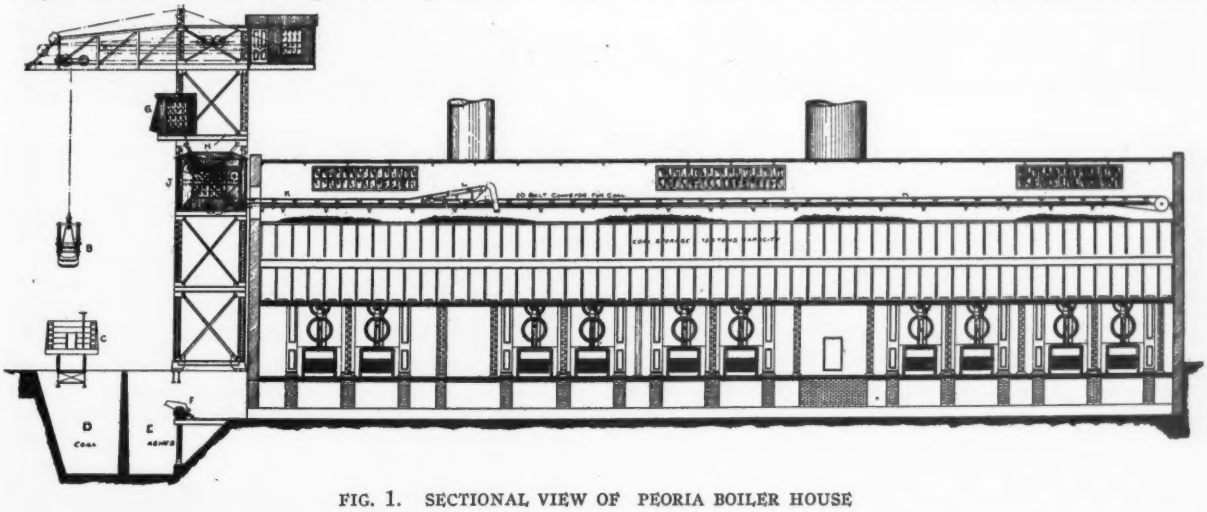


FIG. 1. SECTIONAL VIEW OF PEORIA BOILER HOUSE

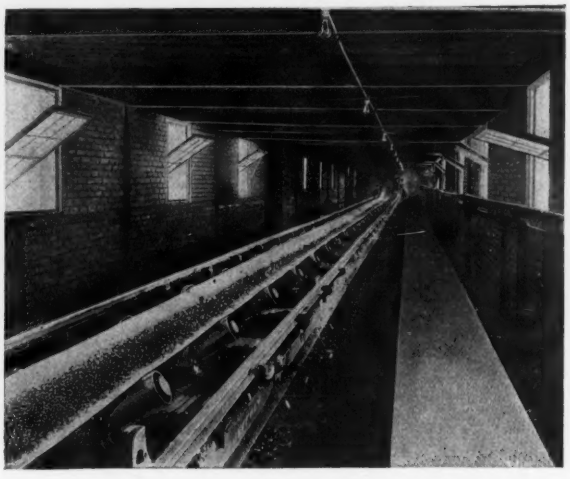


FIG. 3. BELT CONVEYER DISCHARGING COAL INTO STORAGE BINS

On the tower is the operator's station in the cab, where he operates 2 controllers, 2 clutch levers and 1 foot lever to handle and control all the movements of the buckets. Windows are provided in the tower to enable the operator to look in all directions. A single laborer is needed part of the time in the car to clean up the coal that cannot be reached by the grab bucket, but the bucket will handle nearly every particle of the coal, and at no time will more than ½ ton remain in the car.

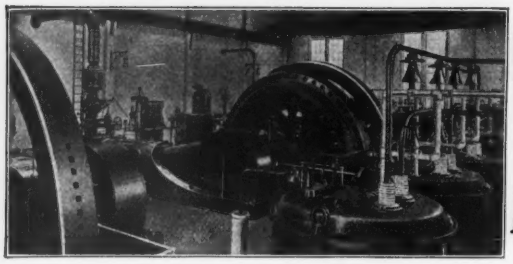
The tower is built of structural steel, weighing approximately 65,000 lb., towering in height 71 ft., and with cantilever truss a trifle over 30 ft. long counter balanced by the machinery house. The method adopted for the removal of the ash is simple and is explained by referring to the drawing, Fig. 1. The ash come from the 10 fires into the deep steel barrows and are taken to the ash pit where they are loaded to the railway cars by the grab bucket.

This entire equipment was designed, built and erected by the Jeffrey Mfg. Co., of Columbus, O. The result of the official tests made by the engineers in charge for the Peoria Gas & Electric Co., have been made known to us and are published here only in a brief way. On May 19 C. P. & St. L. Car No. 1125, containing 30 tons of fine coal, was unloaded by the grab bucket in 25 trips, averaging 1.2 tons of coal per trip, in less than 25 min. The total cost of labor and actual power consumed for the entire 30 tons amounted to less than 40 cents. The cost per ton for handling the coal for a previous 3 months ending March 31 showed a total net saving of over 16 cents a ton, compared with the former methods, when hand labor had been used for this same purpose, and the actual saving of over $10,000 for the first year with the use of this modern installation.

THE BOOKS BOYS READ

EVIDENCE that young people naturally turn to good books—if they are as interesting as highly colored trash—is given in a letter to the publishers of "Boy Life," a volume from William Dean Howells's writings. A teacher in the seventh grade of the New Rochelle New York, schools had read several pages from "Boy Life" to her pupils, and the letter adds: "That afternoon 15 boys from this class applied at the public library for a copy of 'Boy Life.' The teacher, to whom the librarian reported the fact, said that she had not suggested that the pupils call at the library for the book, as she had intended to continue the reading with her class. This incident is certainly a tribute to the charm of this selection from Howells' writings, and makes it plain that grammar-school pupils will respond with enthusiasm to good literature."

ELECTRICAL



MACHINERY AND APPARATUS

PRACTICAL SUGGESTIONS FOR THE YOUNG ENGINEER

ELECTRICAL CIRCUITS AND CONNECTIONS

BY WM. KAVANAGH

COMPREHENSIVE KNOWLEDGE OF ELECTRICITY is desirable but the majority of operating engineers have not the time to study out intricacies of the electric current, practical detail being more essential for the satisfactory operation of the average plant.

The information imparted in this article will deal only with the practical side of the electric current and its use, together with suggestions that will be found helpful in assisting the young engineer to understand various details that are necessary in the every day life of the steam-electrical engineer.

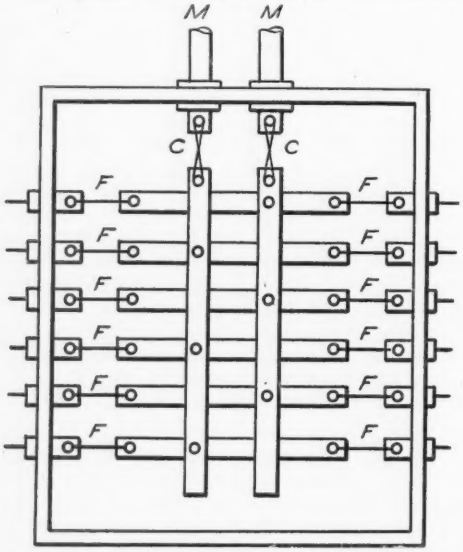


FIG. 1. ARRANGEMENT OF BUS BARS IN PANEL BOX

Necessary Knowledge

THE engineer who expects to make a success out of his business should have a working knowledge of dynamos, motors, balancers, storage batteries, wiring and arc and incandescent lighting. He should know how to wire or connect up shunt and compound motors, understand the structure of starting boxes and be able to make ordinary tests for grounds.

There are 2 principal ways in which electric current is distributed for power and lighting purposes, known as the 2-wire and 3-wire systems, both systems are extensively used in manufacturing plants, hotels, office buildings etc.

Location of Panel Boxes

THE mains carrying the current from its source of generation to be distributed throughout the offices, floors or lofts, as the case may be, are connected to panel boxes that are situated in convenient places.

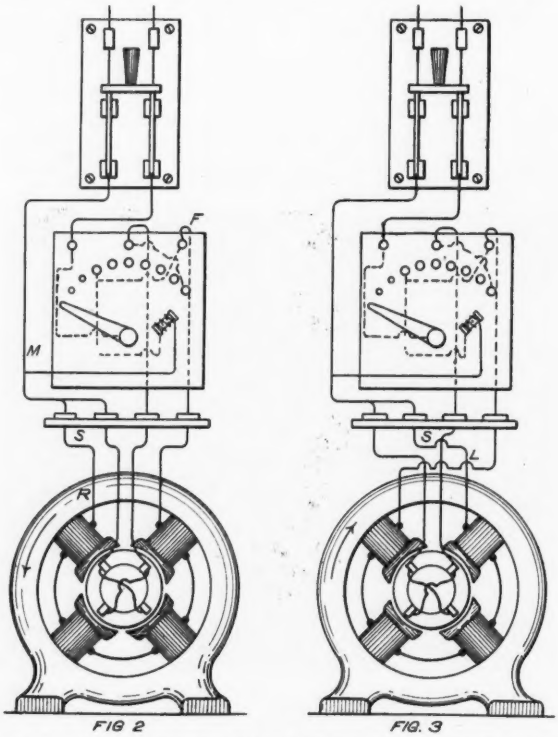


FIG. 2. SHUNT-WOUND MOTOR WIRED FOR COUNTER-CLOCK ROTATION

FIG. 3. WIRING FOR CLOCK ROTATION OF SHUNT-WOUND MOTOR

from which various power or lighting circuits may be led to the required points to furnish light or power as desired. Usually power and lighting circuits are not taken from the same panel box, there being panel boxes installed separately for both purposes in every well regulated plant.

In plants where current is generated for both power and lighting purposes, different voltages may be employed; the higher voltage is generally used for driving motors while the lower voltage is used for arc and incandescent lighting. In the 2-wire system of distribution, the voltage for lighting and power is the same; in the 3-wire system, the voltage for lighting is half that employed for driving motors.

Panel Box Arrangement

REFERRING to Fig. 1 we see the mains, M M, are protected from an accidental short circuit across the bus bars located in the panel box by means of the cutout shown at C, and the circuits leading to motors or lamps are each separately protected from short circuits by fuses shown at F F. Thus we see one or more

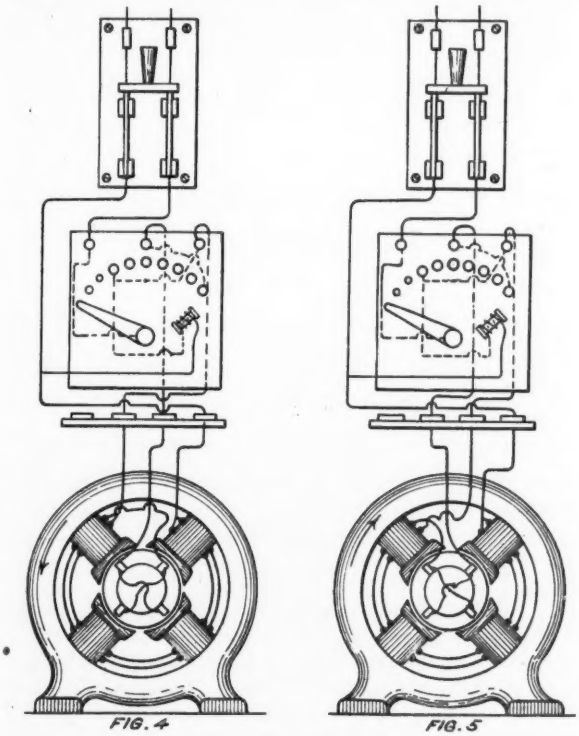


FIG. 4. COMPOUND MOTOR WIRED FOR COUNTER-CLOCK ROTATION

FIG. 5. COMPOUND MOTOR WIRED TO RUN CLOCKWISE

circuits may be blown or out of order without disturbing the regular operation of other circuits leading from the same panel box.

In running wire for the purpose of connecting a motor or circuit of lamps to the mains we have 2 ways of working; we can wire from the motor or lights back to the panel box or we may work from the panel box to the motor or light circuit, in either case the fuses are not connected until the wiring is completed.

Wiring of Motors

REFERRING to Fig. 2 it will be noticed the shunt S, which is connected to the main M, is in turn connected to the field wire, R. This mode of connection produces counter clock-wise rotation. It will be noted that in Fig. 3 the shunt S is connected to the field wire L which produces clock-wise rotation.

Comparing Figs. 2 and 3 it will be seen the wiring of a shunt wound motor for either direction of rotation is the same with the exception of the shunt or field connection. If we stand facing the end of the commutator, as shown in Figs. 2 and 3, we find the shunt is connected to the left-hand field wire for counter clock-wise rotation and to the right-hand field wire for clock-wise rotation.

The wiring of compound motors is the same for both directions of rotation with the exception of the brush connections which are shown in Figs. 4 and 5.

Changing the field and armature wires at the same time does not alter the direction of rotation.

The direction of rotation can be reversed by changing the direction of current in either the armature or

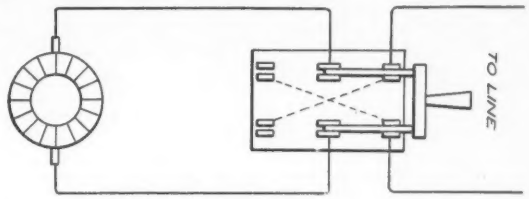


FIG. 6. DOUBLE-THROW SWITCH FOR REVERSING DIRECTION OF ROTATION

field coils. It is preferable, however, to reverse the direction of rotation by changing the direction of current through the armature.

Figure 6 shows a double-pole double-throw switch, wired as shown, which affords a means for immediate reversal of rotation whenever desired. The mains are

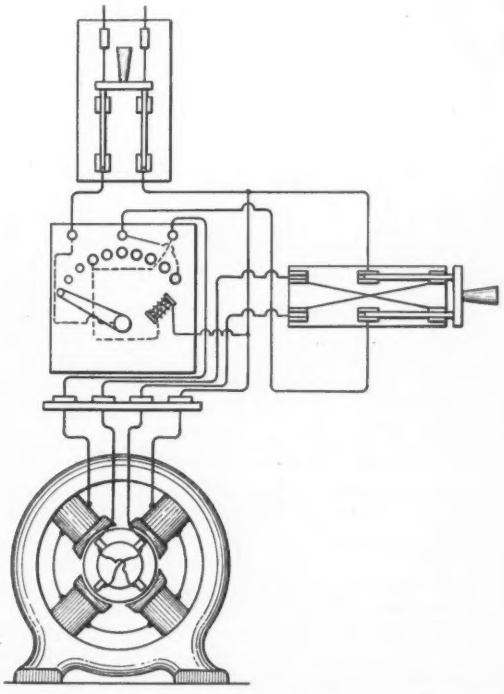


FIG. 7. STARTING BOX AND REVERSE SWITCH CONNECTIONS FOR SHUNT MOTOR

crossed as shown by the dotted lines, and by simply throwing the switch in either direction reversal of rotation is obtained.

This reverse switch cannot safely be employed with motors of medium or large size owing to the rush of current through the armature coils. It can, however, be employed with motors of large size provided a starting box is used in conjunction with it.

Figure 7 illustrates how the starting box and re-

verse switch is wired for a shunt-wound motor; for the sake of simplicity the starting box and reverse switch are placed as shown, but of course they can occupy any convenient position desired. Usually the reversing switch is placed close to the starting box so as to facilitate starting, stopping or reversal of the motor.

Starting a Plant Equipped with a Balancer

IN STARTING up a plant where a rotary balancer is used in a 3-wire system, first get the balancer running before any lighting switches are closed. Second, when the balancer is up to speed, close the lighting switches. Third, should the balancer break down, open all lighting circuits as rapidly as possible. Whenever the balancer is stopped for any reason, the lighting switches should first be opened; in starting up the plant, this method permits the balancer to start immediately after the voltage of the main generator is built up, after which the lighting switches are closed.

Three-Wire System with Storage Battery

FIGURE 8 shows a 3-wire system in which a storage battery is used; here we have a generator of 250 volts connected to a storage battery as shown, which enables the use of 2 different voltages as in any Edison

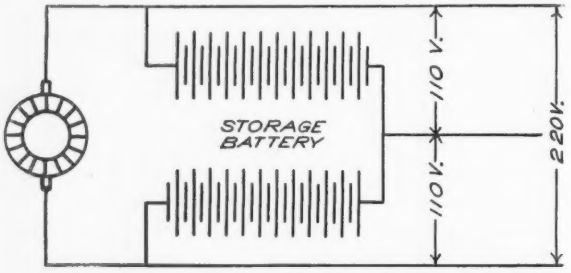


FIG. 8. STORAGE BATTERY USED FOR 3-WIRE SYSTEM

3-wire system. The neutral wire is attached to the battery in such a way that half the number of cells or the number of cells necessary to maintain the lighting voltage is on each side of the neutral wire. When the demand for current is made on either side, the battery on that particular side will begin to discharge while the other side will begin to charge or receive current from the main dynamo. In this way either side of the battery is charged or discharged as the demand for current varies from 1 side to the other.

Care of the Storage Battery

THE engineer should keep the cells well filled and the gravity of each cell up to the standard. Should the gravity of a particular cell become low it can be raised by the addition of more acid; there is no danger of a cell increasing its gravity because the gassing lowers the electrolyte, thus requiring more water and hence the electrolyte becomes weak or low in gravity.

The cells must be kept clean and free from deposit, and the gravity equal in all the cells.

In order to maintain the gravity constant, some particular cell is used as a guide or pilot cell, in which is placed a compensating hydrometer and also thermometer. If the battery room is properly ventilated, the temperature of the cells will be practically the same, hence in testing the electrolyte for gravity it will only be necessary to carry around the hydrometer and immerse it in each cell, the readings of which can be compared with the pilot cell and the cell showing low gravity can be strengthened; by adding acid in this way each cell can be made to do its portion of the work.

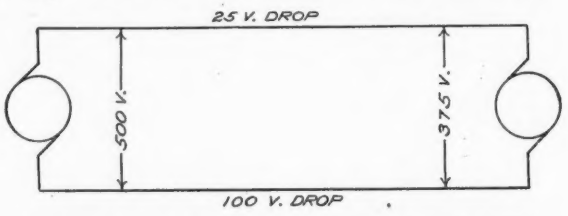
DROP IN LEAD WIRES TO MOTORS

EFFECT OF UNDUE RESISTANCE IN EITHER FEEDER A MOTOR ON THE OPERATION

By W. H. K.

RESISTANCE in motor leads may be due to the following causes: First, the positive feed line may be too small to carry the current required to operate the motor at normal rated horsepower. Second, the line carrying current to the motor may be large enough but the return line may be too small to carry the current needed. Third, the feed wire or positive and return or negative wire may both be large enough, but, if the circuit have a rail return, the bonding between rails may be too small or other connections may not be well done, so that the motor does not get full voltage.

To understand clearly what the effects of any one of these conditions will be, it must be kept in mind that any armature revolving in a magnetic field will generate electromotive force or voltage, whether that armature be a generator or a motor. If a generator, we call this voltage the electromotive force, and for a motor armature, which is driven by the current supplied, we call it counter-electromotive force.



VOLTAGE LOSS FROM DROP IN UNEQUAL FEED WIRES

Unequal Wires

IN the case of a 500-volt generator driving a 500-volt motor, if the positive lead be of sufficient size and the negative lead be only one-half the required diameter for the motor load, we shall have the following conditions: Across the generator brushes there will be an electromotive force of 500 volts. On the positive wire there will be a certain loss in voltage proportional to the current flowing, and this is taken care of in designing the feed line. On the negative return lead there will be another loss in voltage which will be 4 times as great as has been allowed for.

Suppose, for instance, that a 10 per cent loss is permissible. That would be 5 per cent on each of the leads and the positive lead would use up its proper 5 per cent while the negative lead would use up 20 per cent. Thus 25 per cent total of the voltage of the generator would be absorbed in the leads instead of 10 per cent, and instead of having 450 volts delivered to the motor there would be delivered only 375 volts.

Effect on Speed

THIS 375 volts is employed in 2 things, first sending current through the motor armature against the resistance of the armature, second, overcoming the counter-electromotive force which the motor generates when running. The amount required to force current against the ohmic resistance will be the same, no matter what the speed of the motor, and the amount available to overcome counter-electromotive force will, therefore, be cut down by the amount used up in the extra resistance of the negative lead. This will mean that the motor will slow down until the counter-electromotive force which it

generates is that which can be overcome by the remaining voltage from the line.

The only way the motor can get full power is to draw extra current in direct proportion to the lowering of the voltage supplied to the motor terminals, and this drawing of extra current again increases the voltage used up in the armature resistance and cuts down that available for overcoming counter-electromotive force, thus further reducing the speed of the motor.

Now, this same effect will be produced, regardless of whether the extra resistance which uses up voltage be in the positive lead which carries current to the motor, in the negative lead which brings current back from the motor, in the bonds of a rail return, or in the connections and switches. In any case, the voltage available at the motor is cut down when the full load current is flowing.

This cuts down the speed of the motor and allows a larger current to flow, this action and re-action going on until the current delivered to the motor times the electromotive force at the terminals gives a sufficient power to carry the load driven by the motor and supply the motor losses.

ELECTRIC PUMPS VS. COMPOUND STEAM ENGINES

By C. M. Ripley

WHICH is more economical, the electric pump or the compound steam pump, in a building with hydraulic elevators? This is a question which has received a great deal of attention and a contribution is offered through the courtesy of Percival Robert Moses, consulting engineer, New York City, in connection with the Security Mutual Life Building, at Binghamton, N. Y.

Under the direction of Asa P. Hyde, the chief engineer, a series of tests have been run beginning Monday morning, and ending Friday night, of one week, with electric pumps, and the following week during the same period with compound steam pumps.

The following figures represent the test run May 3d to 7th, with the electric pumps, as compared with the run May 10th to May 14th, with the steam pumps. The results are as follows:

	5 Days With Electric Pumps.	5 Days With Comp. Steam Pumps.
Coal Consumed, lbs	34,629	40,177
Gals. of Water Evaporated	365,417	409,581
Lbs. Water to Lbs. Coal	10.5	10.1
KW. Hrs. Generated	4,780	3,230
Number of Elevator Trips	3,937	3,363

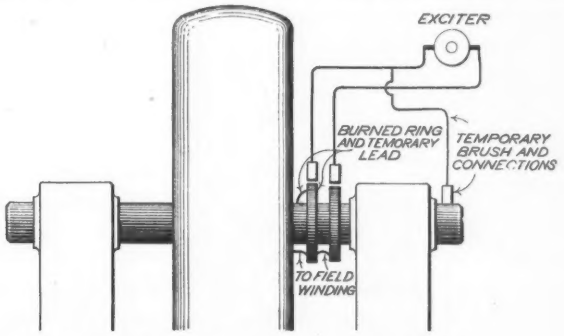
Analysis of the above figures shows that the electric pumps are more efficient. The 2 plunger elevators in this 12-story office building made 574 less trips in the 5 days the steam pumps were in use than during the 5 days the electric pumps were in use. In spite of this fact the coal consumption was 16 per cent greater with the steam pumps running than with the electric pumps. The net result of this is a delivery of 18 per cent more service with a 16 per cent decrease in fuel. This amounts to an increase of 40 per cent in favor of the electric pumps. The 5,548 lb. of coal cost practically $10.00, which for the 5 days' run would indicate an economy of $2.00 a day.

Mr. Hyde states that this is the fourth time he has made such a test and that the results worked out the same way each time. It is well to note, however, that this particular test was made in the month of May. It is possible that in the severe winter months the use of the steam pumps would be more economical in case the exhaust steam from the engines driving the dynamos did not prove sufficient to heat the building. It would probably be preferable to run the steam pumps and heat the building with exhaust steam rather than run the electric pumps and turn additional live steam into the heating system.

In this connection it is interesting to note that the Goulds Manufacturing Company, who furnished the electric pumps for the Security Mutual Life Insurance Company's Building, has been awarded medals by the directors of the Alaska-Yukon Exposition.

REPAIRING AN ALTERNATOR

IN Machinery D. A. Hampson gives the method used for making a repair on the burned collector ring of a 3-phase rotary alternator which supplied current to individual motors. This burn-out tied up the factory, which was engaged in the manufacture of a highly perishable food product. It was important, therefore, that



TEMPORARY REPAIR OF ALTERNATOR

the alternator should keep going and it was necessary to find some way of getting current into the field. Finally the burned ring was connected to the shaft and a temporary brush and connection arranged to bear on the end of the shaft, thus giving a circuit from the brush into the disabled ring. The job took something less than 2 hr. and the machine was put in commission and ran until the arrival of a new collector ring from the factory.

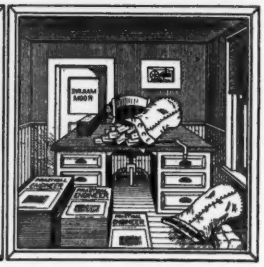
IN THE MAY ISSUE of the American Wire Rope News, which is published by the American Steel & Wire Co., of Chicago, the leading article is an interesting account of the great Detroit River tunnel which was constructed by building sections of the tunnel above water and then sinking them into place. This tunnel had 11 sections which were lowered and connected one at a time and the article gives illustrations of one of these sections, showing how it was built, how it was lowered into place, and what the tunnel will accomplish. It is the first time that the details of this tunnel have been extensively illustrated.

Another article of interest is a description of the great exposition building used in Cleveland in 1909, made out of wire rope and canvas. Derricks were used as tent poles, wire rope as rafters and the canvas as roof.

Breaking strains of rope are also supplied, based upon actual tests of the rope after construction, the strengths on which American wire rope will in future be sold. These tables are of importance, as it is the first time that in comprehensive form the actual strength of wire rope as used has been published. The strength of the rope is as great as heretofore estimated, but the new form of the tables makes them more convenient for reference.

Letters From Engineers

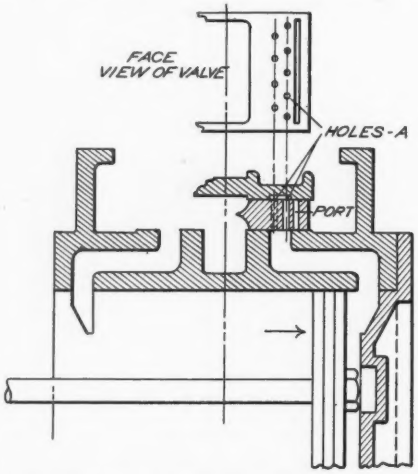
Tell us about your new kinks and new thinks. Rough sketches are always helpful; we make the drawings. Cash paid for accepted contributions.



RELIEVING THE VALVE

IN reply to the inquiry by L. V. Sanderson on page 222 of the April issue I will say that the writer has had some experience with just such trouble as Mr. Sanderson has had. The accompanying sketch shows the position of the valve over the port when compression takes place. The cut also shows the plan view of the valve.

You will notice 2 rows of holes drilled through the valve so that the pressure will be equalized on both



METHOD OF BALANCING STEAM VALVE

sides of the valve or just the same as if a piston valve was used.

There will be no loss in the efficiency by putting in these holes and I am quite positive that the trouble will be overcome. I would like to hear from Mr. Sanderson in regard to this suggestion just as soon as he has tried it. Julius Hamacheck.

COVERING PIPES

ONCE upon a time—as the fairy books say—and not so very long ago either there was a plant had manager as all well regulated plants do, and this manager had somehow conceived the idea that he was saving money for the owners. He could not see any reason for having the engine in a room by itself, so let it stand in the work room of the factory, which is a wood working shop and a mighty dusty place it is too. I have seen the attendant "wipe" the dust from the engine with a shovel and broom.

"It takes boards to partition off the engine from the rest of the mill and lumber costs money, besides the time taken to build it, so we'll let it be," said the super.

"Oh, no," said he, "We won't buy any sheet packing just yet; we can take some of our old worn-out rubber belting and make a few gaskets that will last a while.

"No, the steam pipes don't need any covering; we will use what we have and let the rest go hang. No matter if the brick around the furnace doors have tumbled down and the bridge wall crumbled in a trifle. That can be fixed when we shut down for repairs next fall.

"Steam leaks around the pipe connections? Why, wrap an old pair of overalls around it with a piece of wire and call it good; it will keep back the worst of it anyway."

No one could say but what he was a "cheap man," as far as the spending of money was concerned.

Well, he resigned not long ago and the new super. is an altogether different man. He has had the brick work rebuilt, an engine room partitioned off, pipe leaks attended to, new gaskets where they are needed and all indoor steam pipes covered with asbestos pipe covering and all outdoor pipes covered in what I thought a rather ingenious manner.

First, 3 boards of the required length and wide enough to accommodate the size of pipe being covered were nailed together in the form of a 3-sided box. This was supported by braces so that the pipe passed through the center of the box and the space surrounding the pipe was packed tightly with the following mixture: 1 part asbestos, 1 part ash and 1 part sawdust, and enough water added to form a substance of the consistency of mortar. The box being filled, a board was nailed on top for a cover. After sufficient time had elapsed for the mixture to harden, the braces were taken out and the ends of the different sections nailed together.

For a vertical pipe the box was made around the pipe and the filling done from the upper end. It is evident that those 2 men have different views on economy. Le Roy Scott.

REMEDIES FOR NOISY GEARS

ON page 259 of Practical Engineer for April, under the caption of Noisy Gears, you ask for opinions from readers who have had experience similar to that described. A case has recently come under my observation where the apparatus and the conditions were similar to those described by your correspondent. From the time the pump was put in service it gave trouble and the noisy gears were made the basis of constant complaints until it finally became necessary to send an expert a long distance to make an examination.

His investigations disclosed the fact that the customer's engineers had not properly erected the machinery. The engine shaft and the pump shaft were not in line and therefore the gears did not mesh properly. The pump frames were not securely bolted to the foundation and the slight movement of these frames, together with the distortion of the shaft align-

ment, caused the gears to complain in a manner similar to that described by G. W. D. The pinion was worn on 1 end of the teeth to such an extent that it required replacement. When the new pinion was put on and the above mentioned defects in erection corrected the noise entirely disappeared and ever since then the gears have run as quietly as could reasonably be expected.

Metal gears properly cut will run quietly provided that proper adjustment of the shafts is made and maintained, and provided that the periphery speed is kept down below 800 or possibly 1000 ft. a minute. For higher speeds or imperfect adjustment a rawhide pinion will usually prove an effective silencer.

If the load on the water end of the pump varies during each revolution, it is capable of producing an amazing amount of noise in the gears. A valve stuck open as suggested in your reply to G. W. D. will cause the gears to rattle. I have known of a case where a pump discharging into a tank had a relief valve set at a pressure just about equal to the working head on the pump so that the relief valve worked continuously, alternately relieving and building up the pressure. The gears made a terrible racket but were silenced by half a turn on the adjusting screw of the relief valve.

In a number of instances, on self contained machines, where the gears were all right on leaving the factory, a failure to properly set up the machine has caused trouble. The foundations not being true and the pump being set on such a foundation and bolted down regardless of every consideration except that of holding it fast, the inevitable result is the springing of the pump base enough to throw the gears out of proper mesh and cause them to rattle.

In the matter of noisy gears as well as various other pump troubles, the fault in about 95 per cent of the cases is found to be in the erection, connection or operation, rather than in the construction or design.

H. M. Chase.

AIR-BURNING FURNACE

ACCOMPANYING illustrations will make clear the operation of the Teller furnace, for which much is claimed. Figure 1 is a longitudinal section of the furnace and boiler. It will be noticed that the furnace is a modification of the Dutch oven type. Instead of the air for combustion being admitted in the usual manner through the ashpit doors and up through the grates, it is admitted through a number of circular passages in the arch over the fire, and also through passages of the same form in the side walls of the furnace, which terminate at a point just in front of the bridge wall. The admission of air to the inlet chamber, from which the passages lead, is controlled by means of the damper as shown.

It will be clear that with this arrangement the air for combustion is raised to a high temperature by the absorption of heat that would otherwise be radiated to the atmosphere. It is also claimed that the arrangement gives a complete mixture of the elements and makes possible more perfect combustion than is usually attained, in the common types of boiler furnace. Absence of smoke is also claimed, due to the perfect combustion secured in this furnace.

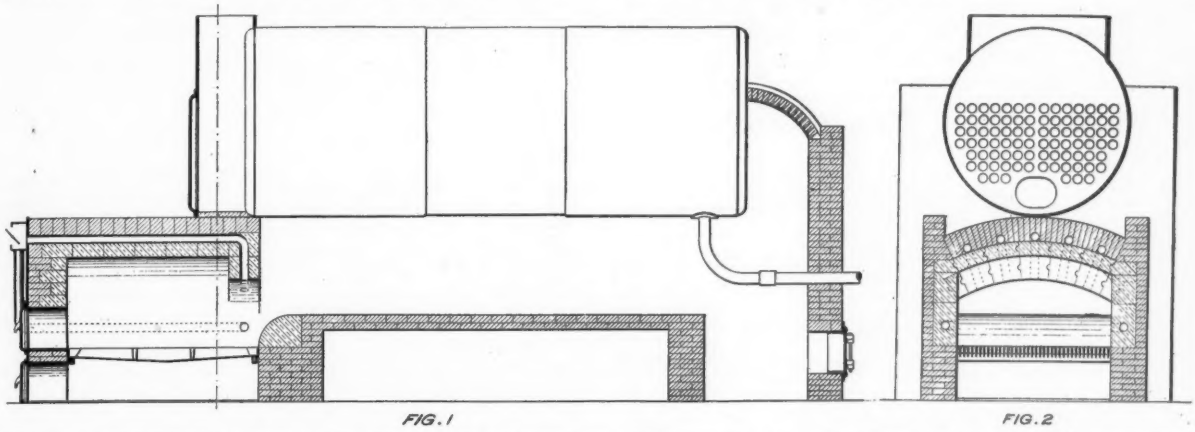


FIG. 1. LONGITUDINAL SECTION OF TELLER AIR-BURNING FURNACE FIG. 2. CROSS SECTION OF TELLER'S FURNACE

Figure 2 simply shows a cross-sectional view of the boiler and furnace. The 2 illustrations show clearly the arrangement of the air passages which are the characteristic features of this furnace.

Wm. Westerfield.

LEAKING WATER MAIN; VIBRATING STEAM PIPE

IT would appear from the statements by S. C. W. on page 203 that those pumps do not run satisfactorily together even on the low pressure.

He does not state what size of nozzles were used on the 4 lines of hose, nor what the speed of the pumps was, nor what the suction lift was.

I believe that the trouble is in the pumps, and since we lack some very desirable data regarding his outfit, it is hardly fair to offer any suggestions, yet I believe that a great deal of the trouble can be overcome by properly adjusting the lift of the pump valves. There may also be some trouble in the steam end of the duplex pump, that will be detrimental to the movements of the water pistons. The lift of pump valves, and the spring tension on them must be regulated so that when the pump runs at its maximum speed all valves seat quickly enough to prevent the water getting back past the valve. If there is a considerable slip of water in this manner, water hammer and vibrating pipe lines are a positive result.

Care must be taken to see that the suction valves work freely particularly on a long lift or the pump will not get sufficient water. I would advise air chambers on the suction lines if the line is long or the lift heavy.

Regarding K. Q.'s question on page 204, I would advise him to put a good receiver separator on the line just above the throttle valve. H. W. Benton.

A PACKING CUTTER

HAVING seen several different kinds of gages for cutting coil packing described in Practical Engineer in the past few months, some of which were quite complicated and costly, I will describe one I made some time ago, which is both simple and accurate. The base A is made of pine 1 in. thick, 3½ in. wide by 16 in. long and shellacked. The gage bar B is about 14 in. long and made of a piece of wood fiber but any hardwood will do; one end is cut on an angle of 45 degrees. The sliding block C is part of an old brush holder of a motor with a piece of 1-16 in. iron bent to an angle of 45 degrees and riveted to it. The bar B is made an easy sliding fit for the block which is clamped to it by the thumb screw on the back side.

The knife guides, DD, are made of ⅛ by 2 in. iron and 2½ in. high, with the slots cut on an angle of 45

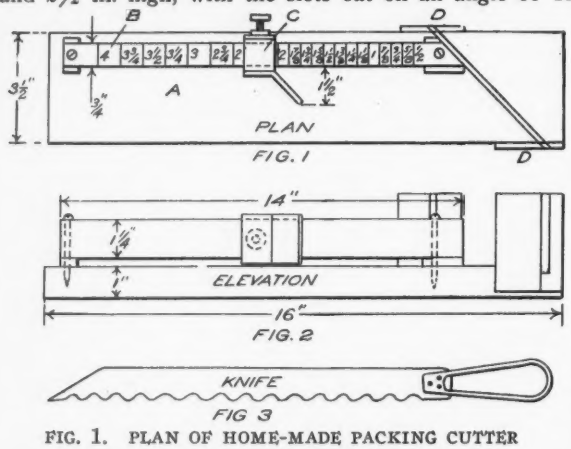


FIG. 1

FIG. 2

FIG 3

FIG. 1. PLAN OF HOME-MADE PACKING CUTTER
FIG. 2. ELEVATION OF PACKING CUTTER
FIG. 3. KNIFE USED TO CUT PACKING

degrees at the end of the bar and set so that the knife will just clear the end of the bar. A common bread knife with a scalloped edge is used for cutting the packing. This is the only expense of the gage outside of the time required in making.

The top of bar B is graduated so that the distance from the knife to the stop when set at a certain number gives the length of the circumference of a circle of that diameter plus 3-16 in. for expansion.

To operate first get the diameter of the rod, which is, say 2 in., add the size of the packing, which in this case we will take as ½ in., equals 2½ in. This is the diameter of a circle passing through the center of the packing ring. Set the gage at 2½ on the bar, cut the first end on an angle in the slot then butt the packing up against the stop and cut it off. This will be the proper length for a good fit with just the right amount of room left for expansion.

To lay off the graduations on the bar get a table of circumferences of circles, which can be found in nearly every catalog and handbook, and to the length of the circumference add 3-16 in. for expansion up to 2 in. diameter, ¼ in. from 2 to 3 in. diameter and about ⅜ in. in sizes above 3 in., after measuring off their distances on the bar stamp them with small figures or other suitable means. The distance from the knife to the 2 in. mark by this method is 6½ in. the 2½ in. mark is 8⅜ in., etc.

This gage can be made in a very short time and in case of an emergency the engineer can get the packing cut to the proper length ready to put in before the engine is shut down. All that is necessary to know is the size of the rod and packing and it saves time, packing and patience over the old way of wrapping the packing around a hot rod and cutting it off with a jackknife and incidentally cutting the edge of the knife off on the rod. The scalloped edged knife will cut the hard asbestos and wire-inserted packing much easier than a jackknife.

This cutter if neatly made and varnished or shellacked, to keep the grease and graphite from sticking to it, can be kept clean, and is no disgrace to any engineer's packing cupboard. Where several rods of different sizes use the same size packing this device will save keeping a lot of different lengths of ring packing in stock.

The reason that the size of the packing is added to the diameter of the rod is so that any size packing can be measured for any size rod, and at the same time, give the proper room for expansion. J. C. Hawkins.

GROAN IN THE CYLINDER

NOTHING is more annoying to an engineer than groaning in the cylinder when the engine is shutting down. Most engineers do not try to find the cause of the trouble, but lay the blame on the cylinder oil.

A short time ago I was talking with a superintendent, to whom, at different times, I had sold steam supplies. He wanted to know if I could get him some good cylinder oil. He said that the oil he was using cost 60 cents a gallon, and it did not do the work.

I did not want to knock the agent who sold the oil, and asked the superintendent if the trouble might not be in the engine. He said no, that it was the oil, for every time they stopped the engine, it would groan as soon as the speed slowed down.

I said I had to go to this plant the following Sunday to take measurements for some new apparatus, and if they had the cylinder open I would try to locate the trouble. The superintendent told me that he had the oil feeding in fast the day before. At night they took the head off, and the cylinder was as dry as if no oil had been put into it.

Sunday we took the piston out and I showed him where the rings were worn to a knife edge, and all the oil that had been fed into the cylinder was simply pushed out the exhaust on each end of the stroke and wasted.

We rounded the edges of the rings with a fine file and put it together, and the engine ran all right with 40-cent cylinder oil.

If strict attention was paid to the inside of the engine as well as the outside, the saving in coal and oil would repay the trouble twice over, along with taking no chance of cutting the cylinder.

Often a set of brasses could be run looser if not for the friction of the cylinder, as the least play in the pins will be detected if the piston is working in a dry cylinder. S. J. Kelley.

ENGINE KNOCK STOPS MYSTERIOUSLY

ONCE upon a time I was coal pusher and grease dauber in a laundry where they had a 10 by 12 in. slide-valve engine, that ran at about 240 r.p.m. There was pressure enough on the private water system to force the water direct into the boiler. The engine had been used a long time, all the brasses had been replaced 2 or 3 times and the governor was badly worn. The miter gears meshed too deep, then the top one was worn uneven, which make it wobble as it ran. If not kept flooded with oil it made a noise something like a dredge boat in motion. This was stopped by placing a washer under the top wheel, thus bringing the wheels farther apart. Then I started curing the knocks; after adjusting all the brasses and equalizing the clearance I noticed a thud in the cylinder, the noise

occurring when the crank was on the crank center. My first thought was that the piston was loose or there was something in the cylinder. On taking the piston out I found neither to be the case. I also found the cylinder to be perfectly round.

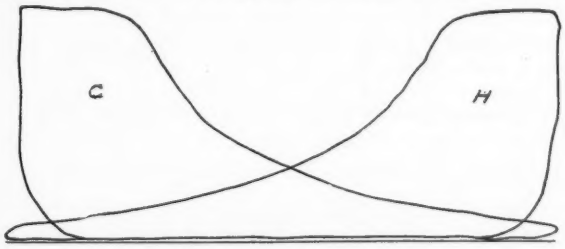
I tried all kinds of lead from 3/16 to negative, also tried unequal leads, but it was the same old story. I then decided that the cross head did not travel exactly in line, thus causing the piston to strike the wall, and let it go at that.

Now the machinery needed lots of attention. It might have been force of habit or it might have been that the laundry maid was pretty good looking, anyway, one day I was in the wash room talking when I heard a pop, pop, and I didn't need any telling to move. When I got to the engine it seemed that some demon was trying to break out of the cylinder with a 50-lb. sledge. I choked it off in record time and had visions of a wrecked engine, but it came through sound.

After draining off some water and starting up I found that the knock had disappeared. Now I want somebody to tell the why of it. Some will say I took up the brasses after equalizing the clearance, but I didn't. After that I always gave the feed valve an extra twist before going to look at the washing machine. F. E.

LONG SERVICE

ENCLOSED herewith is a card taken from an engine at our plant which you may consider of interest to your readers. This engine was built and installed by the E. P. Allis Co. during the summer of 1885 and has run continuously, day and night and Sundays with the exception of about 2 months each



CARD FROM A 25-YR. OLD ENGINE

summer when it runs only during the day time. The cylinder has never been rebored and the same piston and packing rings are doing duty now that came with the engine. The only renewals are crank and crosshead brasses, slide shoes rebabbitted and new valve stems last summer. R. E. Mailer.

SWITCHES, CYLINDER WATER, RECEIVER LEAK

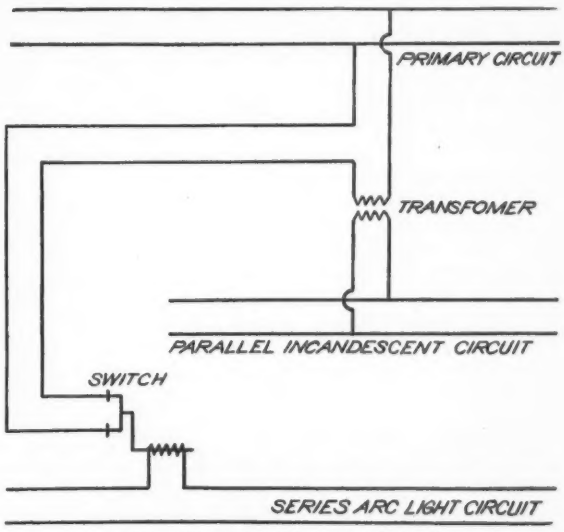
A PAIR of arc lamp magnets with suitable contacts, mounted on a wooden frame, and placed in an old transformer case, comprised the principal parts of an automatic switch. The illustration shows the switch used to control a short incandescent light circuit from an arc circuit. The nearest incandescent circuit was nearly 5 miles distant, and it would not have been profitable to extend the line for so few lamps.

They were first turned on and off by hand, but after being out all night and on all day a few times this method was found unsatisfactory, and the automatic switch was designed to turn on and off the lights at the same time the arc lamps were turned on or off.

Some time ago some oil switches were required in a hurry. Some old airbrake feeder switches were on hand. These were put in tin boxes filled with oil. The switches were placed horizontally with their handles at right angles. The high tension wires were led in through porcelain tubes. This device worked very satisfactorily.

Water was frequently taken by an engine working at the end of a long steam main. Removing the cap from the end of the line, and putting on a drop elbow with the bottom connected to the drip system, effectively stopped this nuisance.

Even after a tandem-compound condensing engine had been shut down several hours the receiver drip was found to be hot. The throttle was proven tight, so suspicion pointed to the reheating coil in the receiver, but to take off the receiver head was a troublesome task. To find out the size of the leak the valves



AUTOMATIC SWITCHING CIRCUIT

between the engine and condenser and all drips were closed. The pressure gage on the receiver soon gave all information necessary. Robt. E. Bradley.

RECEIVER PRESSURE DISCUSSION

A STUDY of the diagrams shown on page 142 of the February issue and of the statements, brings me to the following opinion:

Diagrams, Figs. 3 and 4, show the total horsepower the engine is required to develop. Figure 3 shows that the higher receiver pressure has reduced the power developed by the high pressure cylinder a slight amount, as is shown by the point of cutoff being a little earlier than in Fig. 1. The higher receiver pressure also reduces the area of the high pressure diagram, hence the power developed by the high pressure cylinder as shown by Fig. 3, is less than the power developed as shown by Fig. 1.

I have not measured the diagram, but E. A. B. states that Fig. 4 represents 20 hp. more than that shown by Fig. 2. Assuming that this is correct, then the total horsepower developed, when the higher receiver pressure is used and the exhaust from the pumps is fed to the receiver, is not increased the full 20 hp. but is less that amount, by the decrease in horsepower of the high-pressure cylinder. Hence, by making a reduction of say 5 hp. on the high-pressure cylinder, and a gain of 20 hp. on the low-pressure, we have 20 — 5 or 15 as the effective increase in the total horsepower developed by the engine.

To answer "E. A. B.'s" question direct, it appears that to shorten the point of cutoff in the low-pressure cylinder so as to produce 14 lb. receiver pressure, would give a diagram of smaller area than the one in Fig. 4, hence the horsepower would be less than shown by Fig. 4. It is clear that the exhaust from the high-pressure cylinder has not sufficient volume to fill the low-pressure cylinder with steam at 14 lb. pressure, and maintain this pressure with a late point of cutoff as shown by Fig. 4, and that the steam from the pumps is just enough to make up the shortage, so that it is possible to get the low-pressure diagram shown, and that this additional quantity of steam to the receiver increases the power of the engine 15 hp.

E. A. B. does not state the speed of the engine, nor if this extra 20 hp. is actually required to carry the load. I believe, however, from what he does state that any increase in the load above that shown by diagrams, Figs. 1 and 2, will cause the high-pressure steam valves to hold on, no point of cutoff taking place. From what he states it appears that 15 hp. more than that shown by diagrams, Figs. 1 and 2, is sufficient to carry the maximum load satisfactorily, but that it is impossible to develop that amount of power without the steam from the pumps being used.

We are not told whether or not the point of cutoff for the low-pressure cylinder is controlled by the governor; assuming that it is, I think it strange that E. A. B. does not tell us his receiver pressure gets up to an excessive pressure and his engine slow down when the high-pressure steam valves fail to cut off; or, if the point of cutoff for the low-pressure cylinder is also lost by the low position of the governor, then I wonder why he does not have trouble with his condensing apparatus.

Altogether, one is led to believe that the engine is overloaded, but I am satisfied that the valve gear requires adjusting.

The high-pressure diagrams show too much compression, and a late release. Admission is a little late, particularly on 1 end. The latest point of cutoff is altogether too early. This may be due to the position of the steam eccentric or may be due to the wrong adjustment of the trip collars.

To set correctly the trip collars on the high-pressure cylinder, have the governor on the safety rest in position for starting the engine; now give the engine just enough steam to turn it slowly, then lengthen or shorten (as required) the rods from the governor to the trip collars, so that the steam valve for each end of the cylinder is tripped at its extreme point of travel in the direction that opens the valve. This adjustment, assuming that the engine is fitted with safety cams, positively prevents the high pressure steam valves remaining hooked on under any condition.

All Corliss engines, whether single or double eccentric, should be so adjusted. If these changes are made, the available power of the high pressure cylinder will be increased about 20 per cent.

Regarding the low-pressure cylinder, I will state that the release is late and the valve appears to be slow in opening, and the compression might be a little greater than it is. I believe this is due to the position of the eccentric, and would advise advancing the eccentric on the shaft, and adjusting the length of the exhaust valve rods so as to give a diagram with the exhaust lines together, as in the high pressure diagrams, Figs. 1 and 3.

It is also my opinion that the valve gear is of the single eccentric type, and if so, then advancing the eccentric as above will make it necessary to shorten he dash-pot rods, and lengthen the steam reach rods so as to bring admission correct; it will also be necessary to adjust the trip collars in accordance with the change in the length of the steam rods, otherwise the low-pressure point of cutoff will be later than before.

It appears that steam gets into the compressure cylinder after the point of cutoff and I think it is because the steam valves are not lapped sufficiently to make a steam tight valve.

It is a rather risky thing to make suggestions when full particulars are not given, for a person can miss the mark by quite a distance. If, however, I have read the condition of the engine correctly, the changes as suggested will improve the running of the engine very much and will permit it to develop a greater amount of power whether or not the exhaust from the pumps is used. One thing is positive: the valve gear requires adjustment and the changes stated above will improve it.—Harry W. Benton.

HOT VALVES CURED

THE accompanying sketches show the pipe connections to a compressor which I am running. The compressor is driven by a 250 hp. motor, belt connected. When the machinist set it up he fixed the lead to the release valves as shown in Fig. 1. The result was the valves got hot air and would swell up

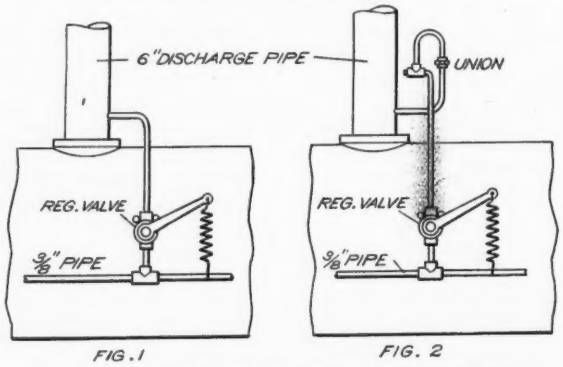


FIG. 1. ORIGINAL RELEASE VALVE CONNECTION
FIG. 2. LOOP CONNECTION TO RELEASE VALVE

and stick and gave a great deal of trouble. I changed the lead as in Fig. 2 taking a long piece of pipe and bending it into a loop, which allowed the air to cool before reaching the valves, and have not had any trouble since. Chas. Sawyer.

HOT BEARING TREATMENT

I WAS in a peck of trouble with a large disk, friction clutch, and 2 4-in. hanger boxes running hot a short time ago and all the common remedies failed to cool them. Finally a friend suggested turning a stream of air which had been compressed to 80 lb. gage pressure for use in our humidifiers on them, and acting on this suggestion inside of 2 hr. those 3 hot pests were as cool as could be desired.

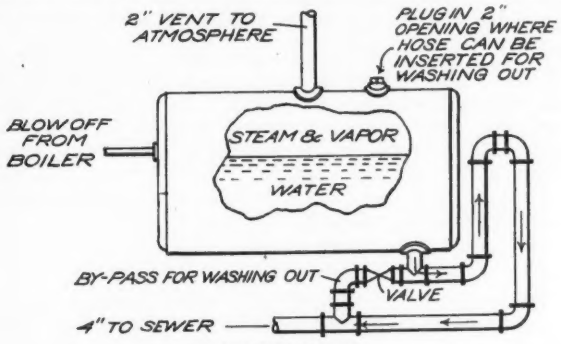
After 2 nights' treatment the hanger boxes did not heat up, but the clutch continued to heat unless the compressed air was kept on it, in which case it would cool down and stay cool. Finally we made a change in part of the construction, and the clutch gave no further trouble.

A new engine recently installed with 18 by 36 in. cylinders running at 95 r. p. m. gave me some trouble by heating in the main pillow block, and twice after I had set the quarter box up too tight it made me

hustle. Finally I tried a ¼-in. jet of compressed air on it, and it cooled down inside of an hour, and is running fit to win a gold medal. If any readers of Practical Engineer are bothered with hot bearings, just try compressed air on them and laugh at the trouble. Wm. E. Chandler.

BLOW-OFF TANK

NO doubt many engineers have had their troubles with the buried blow-off tank, the same as I have. In a plant where I was employed some time ago, this buried type of blow-off tank had been in use. The boilers in this plant were set in a pit below the sewer and the tank was situated above the bottom of boilers so that when washing out, all the mud and about 1/6 of the water had to be run out on the floor and allowed to flow to a well and from there pumped or syphoned out to the sewer. When washing out one boiler it was a


2" VENT TO ATMOSPHERE
PLUG IN 2" OPENING WHERE HOSE CAN BE INSERTED FOR WASHING OUT
BLOW OFF FROM BOILER
STEAM & VAPOR
WATER
BY-PASS FOR WASHING OUT
VALVE
4" TO SEWER

BLOW-OFF TANK

case of firing up the other boiler in order to pump water out of the well.

I was blowing down a boiler one day when I was somewhat startled by a cloud of steam and hot water shooting up out of the ground where this blow-off tank was located. Upon investigation I found that the tank was corroded and eaten through in several places. The accompanying sketch shows how I got out of this trouble.

I designed this tank and had one made up and installed as soon as possible. I set it on top of the floor, and it has worked very satisfactory ever since. Notice that water coming from the boilers is discharged into this tank just over the water level, and, of course, the steam and vapor pass out through the vent. I never had occasion to wash this tank through the by-pass, as the mud and water was syphoned out after blowing down.

A water seal is placed outside of tank, instead of inside, as in the buried tank, and there are no lock-nuts or pipe to work loose and drop off.

The tank is 36 in. long, 23 in. in diameter, made of ⅜ in. boiler iron; all openings are flanged. In installing this tank I placed a by-pass from the blow-off pipe to the sewer line direct, so that I could wash out the boiler without firing up the other. This tank could, of course, be made any size to suit conditions. Any reader of Practical Engineer who has trouble of this kind will do well to install a blow-off tank of this design on top of the floor and his troubles in this respect will cease. Chas. P. Weaver.

BABBITTING BOXES

IN answer to first question, in the May issue, my way of babbitting a rod brass stands up very well, it is first to heat the brass sufficiently hot to melt solder, brush the brass and swab it with muriatic acid and rub the solder on, sweating it well around all edges, leaving surface rough. Then babbitt in the ordinary way and bore to size.

In babbitting an eccentric I would advise that it be done in halves. Lay the half strap on a plain board, place a strip of sheet metal against the face, then place as many thicknesses of sheet rubber, pasteboard or leather, against sheet metal as will make required thickness and tamp well with ordinary moulding sand. First draw sheet metal, then the other sheets, leaving sand surface. Make a negative tin-plate to fit the cam, make a positive from it and bore to size. E. E. S.

PECULIAR INDICATOR DIAGRAM

I ENCLOSE an indicator diagram taken from a new engine which I set up and started on April 11. Who can tell what caused the irregularity in the expansion

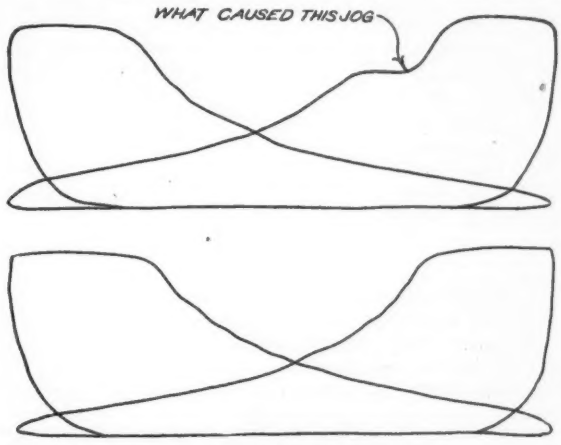


FIG. 1. THE CARD WITH A JOG
FIG. 2. AFTER CORRECTING THE FAULT

line? It was no fault of the builders of the engine, and it took 5 minutes to find and remedy the cause of the irregularity, after which card No. 2 was taken. W. E. C.

AMMONIA IN OIL

ON page 259 in the April issue Mr. E. W. asks a question in regard to diluting lubricating oil to reduce heat of engine bearings. Now I will say that if Mr. E. W. will use one tablespoonful of strong ammonia to ½ pint engine oil and feed through oil cup into the bearing he will be surprised at the results. C. D. S.

LIQUID AIR, WHICH some years ago was hailed as the future motive fluid, is no longer considered in that connection, but it is nevertheless of considerable industrial use. Compressed oxygen is the principal product and is used for welding with the oxyacetylene flame or for cutting out metals. The cost, as given by Mr. George Claude, is surprisingly low. At present a cubic meter of oxygen is obtained per horsepower hour in a plant with a capacity of 50 cubic meters an hour, and Mr. Claude gives as the cost, including depreciation, 0.6 of a cent to a cubic meter.

THE ONLY CURE for indolence is work; the only cure for selfishness is sacrifice; the only cure for unbelief is to shake off the ague of doubt by doing Christ's bidding; the only cure for timidity is to plunge into some dreadful duty before the chill comes.—Rutherford.

Questions and Answers

Ask about your troubles—help the other fellow with his. Give your name and address. For a quick answer enclose stamp for reply.

Questions From an Ohio Examination

WHAT effect does water in the cylinder have on lubrication?

2. What is the difference between high and low-pressure pumps?

3. What per cent is gained in fuel by using feed water at 212 deg. instead of 60 deg.?

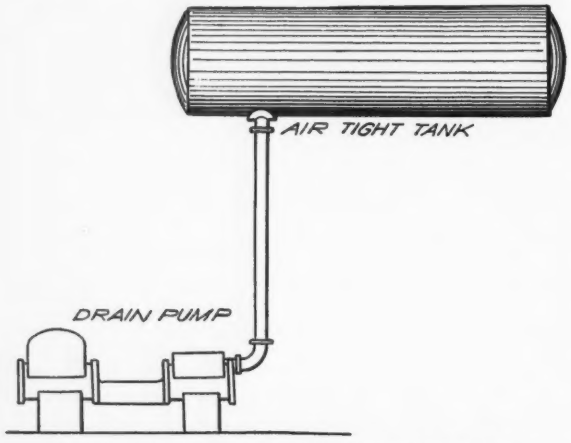
4. A boiler 60 in. in diameter and 16 ft. long carries a pressure of 100 lb. to the sq. in. What is the total strain on the longitudinal seams?

5. What is the difference between a butt joint and a lap seam, and which is the better?

6. What is the hp. of a boiler which evaporates 138 lb. of water a minute at 70 lb. boiler pressure, feed water being at 100 deg. F.?

Pumping Problem

AT the last meeting of our association I was requested to put a problem on the blackboard. It proved to be a very interesting question, almost every member taking part in the discussion which became quite heated. A large and varied assortment of opinions were expressed



ARRANGEMENT OF PUMP AND AIR-TIGHT TANK

but none was absolutely sure that his idea was right. Thinking it might interest the readers of Practical Engineer I send the problem to you.

If the suction pipe of a pump is connected to the under side of an air-tight tank filled with water and at a higher level than the pump, as shown in the sketch, can the water be drawn from the tank? T. A. R.

Ice Can Break

I AM running an absorption ice machine and have trouble with the ice cracking in the cans in the tank at the end where the circulating pump takes out the brine about 1-3 the height of the tank. Temperature is the same all over the tank at about 20 deg. and circulation of the brine in the tank seems all right. The ammonia pipes frost evenly in the tank, calcium brine being used at 80 per cent solution and the strength of the strong liquor ammonia is 27. Can some reader tell me how to get rid of this trouble? T. U. F.

Trouble With Pump Studs

ON my pump, which is a plunger water end 14-in. diameter, carrying a pressure of 95 lb., the gland studs are 1⅛-in. diameter by 8 in. long. We have had trouble with these studs as they break off frequently. We have looked all over the water end and have packed it with new packing, but the studs still break. The pump has been running about a year and I would like suggestions as to the probable cause of the breakage.

Non-Burning Oil

IS there any substance which can be put into engine oil so that it will not burn in a mining lamp? Although it is against the state law, some of our employes appropriate the engine oil which is used about the machinery and use it in their lamps. We want to make it nonburnable without destroying the lubricating properties if possible. H. I. J.

Centrifugal Pump Capacity

WE have a 2-stage centrifugal pump for pumping water from a well which has water level about 30 ft. below ground level into tanks about 75 ft. high, these tanks being 16 ft. deep. The pump is set in the well 5 ft. above high water and the water is frequently pumped down 10 or 15 ft. below the pump. This pump seems to throw its full capacity when the tank is ¾ full to full, regardless of the water level in the well, but when the tank is empty the pump fails to work. In other words, the pump acts all right against a head of 115 ft. but will not pump against a head of 75 ft. or less. The pump is 3-in. driven by 15 hp. motor at 1165 r. p. m. Can anybody explain this action? C. H.

Lining for Brake Band

DO YOU know anything that will be good to use on a brake band for a hoisting engine? I have an old-timer with an iron band and it lowers by jumps. I can't find anything that will make it lower easily. Have to use the band to lower with as it has a clutch for driving the winding drum. A. R.

Use of Exhaust Steam Turbine

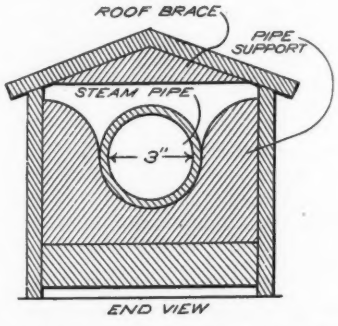
THE firm by which I am employed during the summer months is short of power to the amount of about 400 hp. We have a 20 by 40 by 48-in. Corliss engine running at 104 r.p.m. on 140 lb. steam in connection with water wheels on an average load of 1040 hp. By installing a low pressure turbine and driving part of the factory by motors, could we gain the amount of power required? The engine exhausts into

a vacuum of 25.5 in., which, on this load, is the best the condenser can do. This is a jet condenser. Would it be necessary to install a surface condenser to secure a higher vacuum, or would the higher efficiency of the turbine pay for the new condenser? J. W. L.

A.—A case quite similar to yours is taken up by J. R. Bibbins in the issue of March, 1909. For a 28 and 54 by 48-in. Corliss engine run condensing with 26 in. vacuum, he gets at 1000 kw. load, 20 lb. of steam per kilowatt-hour. For the engine and low-pressure turbine combined he gets a water rate of 17.75 lb. per kilowatt-hour and finds that when increased to the minimum consumption, which is at 2000 kw., the water rate for engine and turbine combined is 16 lb. per kilowatt-hour.

In the November and December issues for 1909 you will find the low-pressure steam turbine quite fully discussed by L. L. Willard, and a careful reading of these 2 articles will give you a pretty good idea of where this matter stands.

Mr. Willard shows here figures which agree substantially with those of Mr. Bibbins, so far as steam consumption is concerned.



ARRANGEMENT OF PIPE COVERING

You evidently have no possible use for the exhaust steam from your engine, so that it is a case of condensing anyway. You can, of course, get more power out of the low-pressure steam turbine than out of the low-pressure of an engine, because you can expand to a lower vacuum and the energy available between 26 and 28 in. is a large part of that in the steam. The low-pressure turbine is, of necessity, however, a large machine for the horsepower developed as compared to the high-pressure turbine, and it requires a much larger condensing outfit to maintain 28 in. vacuum than 26 in., at least twice as large.

It would not be necessary to use a surface condenser to hold this low vacuum, but it would be necessary to install another jet condenser at least as large as the one you now have operating, to be operated in parallel with the present apparatus.

It is impossible to say with certainty just how your conditions would best be met without a careful study of the whole situation on the ground, because the amount of condensing water that you have available must be greatly increased when using the 28-in. vacuum, and other conditions might be such that it would render the turbine installation inadvisable. Probably, however, with your water power it would be possible to run the tail water through the condenser in sufficient quantities so that the matter of condensing water is of no consequence to you.

If it is a case of must have more power, then the question becomes one of an increased steam plant, including boilers, engines and auxiliaries, or increasing the power with the steam turbine, and the question of the steam turbine becomes one first of whether the outfit would give the necessary power, second, whether it would do it at a less cost than additional engine installation.

The study of the curves in the December issue will help you better than anything else to an understanding of this point.

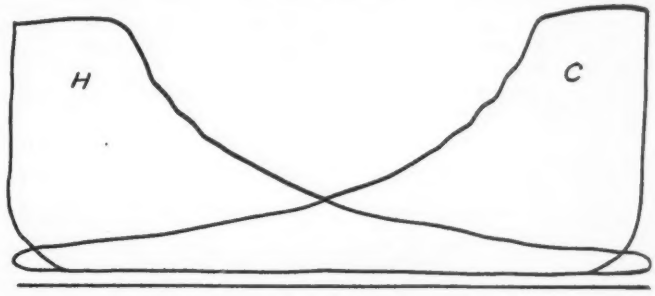
Pipe Covering

I AM making a covering for an outdoor pipe line with boxing something like the sketch herewith and want to fill it with some preparation which can be removed in case the pipe springs a leak. I want something which will be light, cheap, a home-made preparation and will retain the heat. The pipe run is about 375 ft. long.

A. L. J.

Diagrams for Explanation

I ENCLOSE a card from a Hamilton Corliss Engine, which exhausts through the dryers of a paper machine with a back pressure of 60 lb. I would like to have some of the readers look over these cards and let me know what changes can be made to better



DIAGRAMS FROM HAMILTON-CORLISS ENGINE

them. What makes wavy expansion lines, and what is the horsepower of the engine? The cylinder is 14 by 30 in., steam pressure 95 lb., scale of spring 60 and speed 90 r. p. m.

Setting Valves

I WOULD like to know if, in setting the slide valve on an 18 to 22 in. Houston, Stanwood & Gamble engine, you gave it 1/32-in. lead on the crank end, would turning the engine in the direction it is to run to the other center give the valve on the head end a lap equal to the amount of lead given on the other center. How can I make it show very nearly the same amount of lead on both centers?

2. Would also be pleased to know why, in some of the Filer & Stowell make of engines, the connecting rod between the valve and eccentric is raised, or can be raised or lowered in a slot. What is its advantage and what is the rule for setting that kind of valve?

J. S. A.

A. The 18 by 22 H., S. & G. engine is probably designed with the leads unequal in order to get the cutoffs to come nearer equal. You probably know that in designing a D valve engine it is impossible to equalize both lead and cutoff, and frequently, in order to keep the cutoff somewhere near the same on the 2 ends, the lead is thrown out of balance. This is probably the case with your engine.

2. It would seem that your engine is intended to run with very little, if any, lead on either end. In the other case, of the Filer & Stowell engine, the valve is driven by means of a rocker arm. The longer the

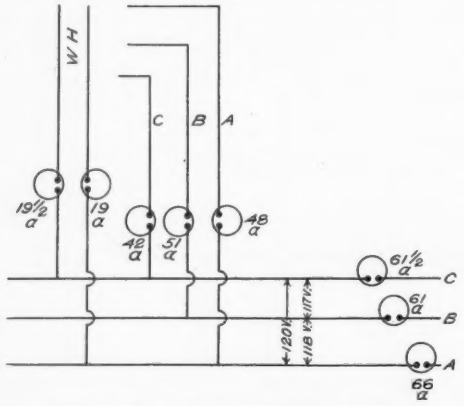
arm is made for the eccentric rod, the shorter will be the travel of the valve, and vice versa. A short valve travel gives late admission, early cutoff, late release and early compression, while a long travel gives early admission, late cutoff, early release and late compression. It is thus possible to vary the cutoff and compression by the position of the eccentric rod or valve rod in the slot, as the case may be.

If it is the end of the valve rod which moves in the slot, the longer arm you give to the valve rod the longer will be the travel, and vice versa. The valve is set exactly the same as if the slot were not there and then the length of the valve travel can be regulated by the position of the rod end in the slot.

Ammeter Connections

WE have a 3-phase alternating-current generator of 300 kw. capacity, 2200 volts and 7200 alternations per minute, current of which is distributed to 2 towns, 3 wires to one and 2 to the other. All 5 wires leave 3 bus-bars at the switchboard and each bus-bar has an ammeter connected to it. There is also an ammeter on each of the line wires.

1. Now one electrician claims that in taking a record of the amperes that only one instrument should be connected on the line I have marked W H, as one is the return wire, but when the amperes on the lines that lead from bus-bars A and C are added together they correspond with the reading of the meters on the machine. Which is right and why?



LOCATION OF AMMETERS IN CIRCUIT

2. What would be the horsepower and how should it be figured?

3. How can I figure how many amperes the machine will carry safely? F. C. H.

A. For the 2 wires which form the circuit W H the readings on the 2 ammeters should be the same, as evidently the same amount of current is flowing in one as in the other. For the 3 wires there may not be the same load on all the wires; that would depend upon the way that the lights are connected. Of course, if you add together the ammeter readings for the 3 wires that lead from the bus-bar A, they will equal the amperes coming from the machine in the wire A, but this same current that goes out in wire A comes back on wires B and C.

2. To figure the horsepower on the circuit to W H we must know the voltage between the 2 wires, the current, and the power factor. We would then multiply the current by the voltage and the power factor, which would give us the watts, and divide by 746, because there are 746 watts to a horsepower. Figuring the power on the 3-phase circuit is not so simple. The easiest way would be to multiply the 42 amperes by the voltage between B and C, and by the power factor of the circuit BC; multiply the 48 amperes by the voltage between A and B, and by the power factor of the circuit AB. Then add these results and divide the sum by 746.

3. To find the safe current which the machine will carry on 1 wire, divide 300,000 watts, the capacity, by 2,200 the voltage, and by 1.732. This will give the safe current on 1 wire of the generator circuit, which is approximately 78½ amperes.

Horsepower, Valve and Electrical Problems

A GRADE 1000 ft. long has a rise of 50 ft. What hp. is required to draw a load of 200,000 lb. up the grade in one minute? Assume the friction to be 2 per cent.

2. What width of double belt is required to transmit 40 hp., the speed of the belt being 1000 ft. and the arc of contact 180 degrees?

3. A pound of ice has a temperature of 10 deg. F. What amount of heat is required to convert it into steam at 40 lb. absolute pressure?

4. What is the angle of advance in the following cases, where the angle of advance is 30 deg.: (a) Direct valve, reversing rocker; (b) indirect valve, reversing rocker; (c) indirect valve, direct rocker; (d) direct valve, direct rocker? Is the magnitude of the angle affected by the fact that the engine runs under?

5. In a 26 by 40-in. engine it takes 10 lb. of water to fill the clearance space at one end. What is the clearance, expressed in percentage?

6. If cutoff occurs when the piston has traveled 12 in. what is the real ratio of expansion of the engine above mentioned?

7. In a simple noncondensing 12 by 26-in. engine, cutoff occurs at 5/8 stroke. If the number of revolutions is 100, and the steam pressure 90 lb. what is the approximate horsepower developed?

8. In a triple-expansion engine having a 28, 52 and 72-in. cylinder diameter the stroke is 4½ ft. The m. e. p. in the cylinders are respectively 60, 38 and 18 lb. Find the indicated hp. of the engine at 100 r. p. m.

9. A shunt-wound dynamo generates an electromotive force of 115 volts at its brushes; what will be the current through the shunt field coils if the coils have a total resistance of 460 ohms?

10. Each of 2 wires contains 100 cu. in. of annealed copper. One is a round wire ½ in. in diameter, and the other is a square wire ½ in. on a side. Which wire has the greater resistance? Give the length and resistance of each wire. J. K.

A. The rise of 50 ft. in 1000 would make the pressure against the supporting surface 0.998 of the weight, approximately. Then for 200,000 lb. the pressure on the surface would be 199,600 and 2 per cent of this would be 3,992. This force would have to be overcome to a distance of 1000 ft. a minute, which would give 3,999,200 foot pounds.

In addition to this the 200,000 lb. has to be lifted 50 ft., which would give 10,000,000 foot pounds, a total of 13,999,200 foot pounds in a minute. Dividing by 33,000, the foot pounds per minute to give 1 hp., we should have approximately 423 hp.

2. At 1000 ft. a minute, to transmit 40 hp. for double belt the belt required would be 21 in. wide.

3. The specific heat of ice is 0.504. If you start with ice at 10 deg., in order to raise 1 lb. to 32 deg., melting point, you will have to raise it 22 deg., which will take 11.09 heat units. The latent heat required to melt ice is 144 B. t. u. per lb. Then to convert it into

steam at 40 lb. absolute will require 1163.4 heat units or the total would be 1315.49 B. t. u.

4. You ask what is the angle of advance when the angle of advance is 30 deg. If the angle of advance is 30 deg. it will be 30, no matter what kind of an engine or valve gear you have, because the angle of advance concerns only the eccentric position.

5. A 26 by 40-in. engine will have an area of cross section of 530.93 sq. in. and stroke of 40 in. would give a cylinder displacement of 21,237.2 cu. in.; 10 lb. of water will have a volume of 276 cu. in. and the clearance percentage would then be 276÷21,237×100=1.29.

6. 12 in. would be 12÷40 or 0.3 stroke. The real ratio of expansion would then be 1.013÷0.313, which would be 3.23. An engine cutting off at 5/8 stroke and with clearance neglected will have a mean forward pressure 0.92 of the initial pressure. In your case the initial pressure is approximately 105 lb. absolute, so

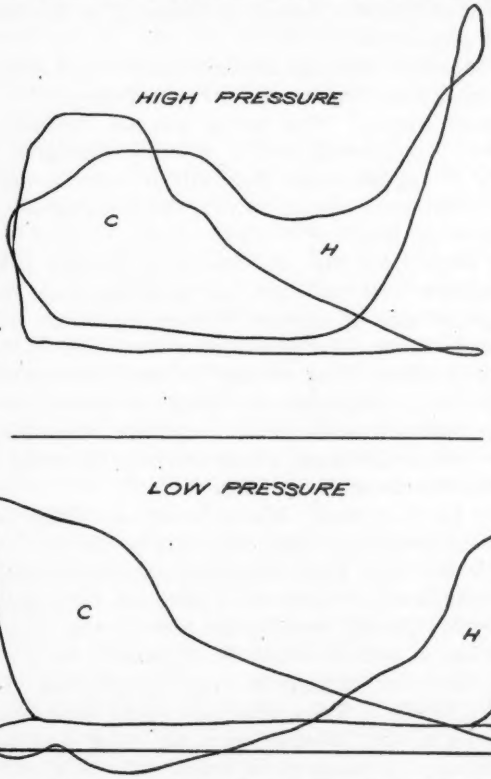


FIG. 1. CARDS FROM BUCKEYE ENGINE WITH 100 LB. STEAM PRESSURE

that the mean forward pressure would be 96.6. Subtracting the back pressure from this gives 81.6 as the mean effective pressure. Then from the hp. formula we have

81.6×26×113.1×200÷12÷33,000 will give the hp., which is 119.3.

8. In the high-pressure cylinder the area is 615.75, the m. e. p. is 60. In the intermediate the area is 2123.7 and the pressure is 38, and in the low-pressure the area is 4071.5, the pressure is 18. In each cylinder the product of area and pressure should be taken and the sum of these products found. The first product is 37,000, the second product is 80,750, the third is 73,350. The total would then be 191,000. This is to be multiplied by 4.5×100×2 and divided by 33,000 to get the total hp., 5,210.

9. Current will be the electromotive force divided by the resistance, 115÷460, which will give 0.25.

10. A round wire ½-in. in diameter has a cross section of 0.1963 sq. in. and the length will be 100 divided by this, or 510 in., or 42.5. A square wire ½-in. on a side has a cross section of 0.25 sq. in. The length will be 400 in., or 33.35 ft. The resistance of a cubic inch of copper is 0.0000006774. Resistance varies directly as the length and inversely as the area. For an inch in length of the round wire the resistance would be that of a cubic inch divided by 0.1963, and for 510 in. in length it would be 510 times this, which equals 0.001763. For the square wire the resistance of a cubic inch will be 0.0000006774 divided by 0.25 and multiplied by 400, or 0.001082.

Cards From a Buckeye Engine

THE accompanying cards were taken from a high speed compound Buckeye engine which has recently been installed. Their peculiar shape has caused considerable comment among engineers in this vicinity

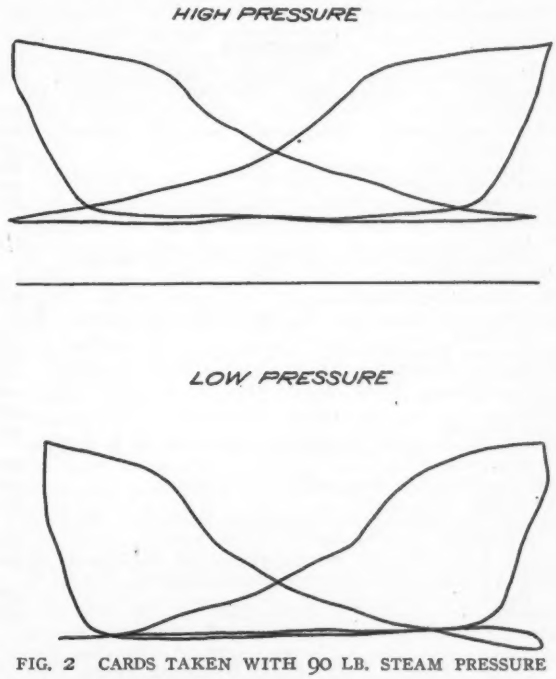


FIG. 2 CARDS TAKEN WITH 90 LB. STEAM PRESSURE

and I would like to know what readers of Practical Engineer think of them.

Cards in Fig. 1 were taken from the high and low pressure cylinders with a 40-lb. spring when the engine was running at 180 r. p. m. and steam pressure was 100 lb. Figure 2 shows cards taken with a 60 lb. spring, steam at 90 lb. and speed at 180 r. p. m. The dimension of the cylinders are 14.5 and 25 by 18 in.

H. C. P.

AT THE ANNUAL MEETING of the stockholders of the Joseph Dixon Crucible Co., the old board consisting of Geo. T. Smith, William Murray, William H. Corbin, Edward L. Young, Geo. E. Long, William H. Bumsted and Harry Dailey, were unanimously re-elected. The board of directors re-elected the former officers, namely, Geo. T. Smith, president; William H. Corbin, vice president; Geo. E. Long, treasurer; Harry Dailey, secretary; J. H. Schermerhorn, assistant treasurer and assistant secretary. William H. Corbin was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers.

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WHY LICENSE?

It's in the air; it has been the topic which has claimed first place at every state meeting this year and it is a ready cause of argument, for and against, wherever engineers meet. "Doctors are licensed; why not we?" "What's the use? License laws are only another chance for graft"; these are chance pickings from the opposing camps.

For the public at large, the advantage of having such regulation as will ensure that competent men are in charge of apparatus, which it is admitted may become dangerous, is evident.

Men killed by a bucking boiler or a flywheel run amuck are just as dead and just as big a loss to their families and the community as if they died of malpractice of a quack doctor or poison in a carelessly mixed prescription.

What effect then can be feared which may reasonably antagonize engineers or their employers? "It may raise wages." That surely will not frighten engineers. As to employers, it certainly will raise the quality of engineers and they will be worth a better wage. The more a man knows, the more money he can save in operating a plant.

"I might lose my job because I couldn't pass." No engineer ever said that, but doubtless some have thought it and so opposed license legislation on a different excuse. For those who have run in their present positions long enough to have proved their ability, every proposed law makes provision for a license without examination. By the time that a bigger job comes along, a man ought to be ready for an examination without difficulty.

How has it worked? Massachusetts and Ohio have had state license for some years and in Illinois, Iowa, New Jersey, New York, Pennsylvania and some other states the laws permit of city ordinances for licensing engineers. Nearly every large city in the optional states has an ordinance and the engineers are in favor of it, also the employers. Letters gathered from manufacturers in Sioux City, Ia., where local license has been in effect several years, are filled with commendation; "a calamity to repeal it," "is a protection to the employer and is raising the standard," "a protection to the public and a benefit to owners," "the entire proposition meets with our approval," "it secures better men and minimizes the danger of accidents."

Should an engineer oppose a law which raises the standard of his profession?

Should an employer oppose a law which secures better men and is a benefit to him?

If the general principle of license is good, it becomes a question of the detail provisions of the law. What machinery shall be exempt from its provisions? Who shall be relieved from examination? What grades, if any, shall be established and how determined?

These are matters of judgment and to a certain extent of circumstances, but a spirit of liberality may

well be shown by engineers in accepting on all these points the will of the majority so far as it can be found out. It seems obvious that heating boilers run at a few pounds pressure must be exempt; whether 8 or 13 lb. be set as the limit would seem of little moment; it will hardly be set higher than 20 at most. Locomotives are dangerous, but without a national law they cannot be included as they cross state lines. Plants where Uncle Sam is watching are already taken care of, and engines and boilers of small power are dangerous mainly to the man operating them, hence are not a matter of public interest.

Omitted examinations are a harder problem. If a man has a city license, where the examining board is straight, another examination seems useless. If a man has run a plant 2 or 3 yr. successfully he has seemingly proved his ability to handle it. There might be other conditions which warrant giving a license without examination, but they are not of general application.

Grading of licenses, that's where the sparks always begin to fly. "Anybody who can safely run a 20 hp. plant can handle a 2000 hp." is one statement; "a man's ability ought to be shown by his license" is the other side. Neither is true. And nobody whom we ever saw is wise enough to say why 3d class should stop at 75 instead of 125 hp. or why a mark of 92 per cent should be first class and 89 per cent second class. If there must be distinction, let the license as printed have place for the different subjects of the examination—including practical handling and experience—and for the percentage or the grade letter attained in each subject. That's grading enough and tells the whole story.

Any law to get passed must confine itself to a few simple fundamental provisions, and details be marked out later by amendment or supplied by the executive officers. Such a law has been shown by experience to be worth the help of engineers and to be of help to them. It is well to be an association of one, if no other association offers, and to play politics to the extent of seeing that all lawmakers realize the wholesome results of such laws.

OFF DUTY

What a lot of conceited idiots we are anyway when you stop to look at us! We think we can control our destinies and that we know how to get what we want and to make crude, dumb material do as we please. Then something happens and we suddenly make a "discovery." Was it our fault or any credit to us? That depends on why the something happened.

Was it because we were trying to get a result or was it just a "lucky mistake"? The result will be the same anyway. This isn't pessimism; not a bit of it. If we don't "keep a goin' " we never will get anywhere, but it's well to remember that after all we are not the whole thing and Providence takes pains to keep us well reminded of that fact.

If you want to stand a chance of getting results you have to try to get in keeping with the laws of Nature and work with her, even if you don't always understand the rules of her game and she sometimes surprises you by springing a new one that you hadn't known before.

All which is a consequence of what? Dr. Acheson, who deserves of his fellow-men all that they can give him in return for the service that he has rendered them, is a tireless investigator. In a way he is like Edison, always trying new things to get a certain result, but warily watching for anything which may happen "on the side."

And so he got by the way of trying to make diamonds some crystals of black hard material that will grind everything, even a diamond; it turned out to be the best and hardest grinding material known and as Carborundum became worth more than the diamonds he sought to make.

Then from this operation of making the exceedingly hard Carborundum, bobs up another product, just a "happen so," which turns out to be the softest kind of graphite, a fine lubricant. And so with her usual contradictory spirit Dame Nature makes in the same process, side by side the best material for cutting metals and the finest material to prevent cutting.

Most of us in our younger days have been reduced to an extreme condition of smallness by a good old-fashioned "tanning" either physical or mental. But who ever would have thought of tanning a metal to "break it up" fine. That's where the brilliance of an original mind came in. Again a by-product of Dr. Acheson's experimenting came into use, but this time with full intention to get a result.

Tanning certain clays with vegetable juices had reduced them to finer particles than any process of grinding or pulverizing—seemingly to the molecules of which chemists talk, but which they couldn't catch until just recently; and that's a mighty interesting story, too, but it has to wait until some other "off-duty" day. Well, if loading clay (or men) with vegetable juice causes utter dissolution to primary, infinitesmal, cellular composition (our pocket dictionary costs only 25 cents), why not try it on graphite? And there he had the stuff which is 1.8 times as heavy as water, so fine that it floats like dust in water, or even in oil; and it will not settle out; you can't even strain it out. All because he played the game according to Nature's rules.

That's all Science is trying to do, find out Nature's rules, and theory is an attempt to put them into words. All the rules don't get into the books, and that's why the book-learned man makes mistakes; he doesn't know the rules that are common knowledge in men's heads. And that's why the man who never reads gets only a little way; he knows only what he learns by playing the game, and doesn't find out those rules that are gathered into the books and papers from the thousands of men he can never meet.

The man who spends his life finding out the rules for the love of finding them is the scientist. He who sets himself to apply these rules for the benefit of his fellow-men is the engineer. The world needs both, and, if we study any man who makes a notable success, do we not find that he is a combination of scientist and engineer in his own particular line? And if he is at all tolerable as a good companion he will have the sense of humor to know that he frequently gains as much reputation from things he didn't mean to do as from his most carefully planned work.

ILLINOIS STATE CONVENTION OF ENGINEERS

HELD AT THE MANUFACTURERS HOTEL AND THE K. P. HALL, MOLINE, MAY 21 AND 22

SYMPTOMS of the convention began to be evident on the evening previous, as the first event on the docket was a reception on Friday at the headquarters in the hotel. No stated program was prepared, and, in fact, those present had all they could attend to in completing the preparations for the morrow.

On Saturday morning the severe attack of "Conventionitis" came with the influx of delegates on the early trains. Engineers are notably early risers and by 7 o'clock the hotel was lively and bidding for accommodations began. Those who had reservations were calm and serene, those who had not were anxious and wondering, but everyone was finally taken care of in the best of fashion.

Formal exercises began in K. P. Hall at 9:30, the convention being called to order by J. H. Bein, of Moline, chairman of the convention committee. As the meeting gathered, it was evident that it was the largest meeting which the Illinois State Association had ever held and the delegates were all there with definite ideas as to what should be accomplished. The results of the convention proved that they kept this matter well in mind throughout the proceedings.

FIG. 1. DELEGATES AND VISITORS AT MOLINE CONVENTION

President's Address

IN taking charge of the convention President J. L. Randles, of Peoria, outlined the aims and objects, education, financial assistance where needed, and fraternal help in bettering one's condition mentally and morally and emphasized the point that conventions and meetings of the association should be a place where a member's whole character is strengthened rather than otherwise, and that all influences of the meeting should be toward this end. In commenting on the need of license law, to the framing of which a large part of the work of the past year has been given, he showed that during 1909 there had been 550 boiler explosions resulting in 233 persons killed and 422 injured, with a property loss running into the thousands, which cannot be definitely estimated.

President Randles defined "opportunity" as the space between a man and his higher ideals. Each member is an instructor for all other members, and the association gives him great opportunities as it is bound to raise his higher ideals.

If a man have no ambition, he has no opportunity, for his ideals do not give him space to grow. If he has high ambition and will not work, his opportunity is limited. If he has high ambitions and adds to this industry, his opportunity becomes unlimited and his capacity for enlargement is increased because of that opportunity and chance for growth.

City Attorney Ben Bell welcomed the convention, and National Secretary Raven, of Chicago, accepted the welcome and expressed the thanks of the delegates for the greeting.

The principal address of the morning was by Dr. J. A. Udden, professor of natural sciences at Augustana College. He spoke of the formation of coal, tracing the process from the deposit of vegetation, afterwards covered with sand and silt under a shallow bed of water and subjected to pressure away from the air until it passed through the stages of peat, bituminous, lignite and anthracite.

This result is accomplished by a heavy growth of vegetation in a warm, even climate which causes a large vegetable accumulation. Following is the sinking of the land beneath the water and the deposit of sand on top. In Pennsylvania, for instance, some 20 beds, in Alabama 30 and in Nova Scotia no less than 80 beds have been reported lying one above the other, sandstone and shale lying between the coal veins.

Estimating the formation of a single coal seam as requiring 50,000 years and an equal amount of time for the formation of the layers between the coal seams, Dr. Udden found the time required for the formation of the Pennsylvania beds to be 2,000,000 years, and estimated the time required for changing the peat into bituminous coal as 10 times as long. In other words, the time required for the formation of the coal has been 20,000,000 years and this was contrasted forcibly

with the rate at which we are now using up the supply.

Following this was an address by H. S. Dickinson, superintendent of manual training in the public schools of Moline and principal of the Manual Arts School. Mr. Dickinson is inaugurating a half-time system to begin next fall in which half of the time of the boys will be spent in the shops of Moline on such industry as the boy may choose, and the other half to be spent in the school room.

Mayor K. F. Ferrol and John F. Alt, of Ottawa, on their arrival early in the morning announced that they were there to take the next convention to Ottawa, and Mayor Ferrol in a speech that proved that he was a good politician looked at from any angle, carried the convention with him and won the vote for Ottawa. If one were inclined to be supercritical, the offer to bring down Lee O'Neil Brown to help in getting the convention might be considered as a reflection on the character of the convention, but it was passed over good-naturedly inasmuch as no jack pots or bathroom appointments were mentioned.

Adjournment was then taken until the afternoon meeting, which came promptly at 2 o'clock.

Educational Contests

REPORT of the license committee was next taken practically all local associations which are members of the state association, and the audit showed a satisfactory gain in funds on hand. The report of the educational committee made by W. G. Lighty, of Chicago No. 1, told of the systematic work which had been done in preparing educational matter for the local associations and keeping track of the work done on these questions.

For the best educational work gavels were awarded to Moline No. 17 and to Peoria No. 6. The importance of this educational work is thoroughly appreciated by all members and in moving the vote of thanks to the committee for its excellent work Mr. Hoff, of Chicago Heights, presented the educational fund with $5 for the work of the coming year in the name of his association, and Chicago No. 1 added another $5. Assurance is thus given of the appreciation of the work of the committee and of the carrying on of that work to still greater success.

License Law Report

REPORT of the license committee was next taken up. This was read by sections, each section being open for discussion as it was read and the whole being acted upon as a unit.

The committee, of which A. E. Reynolds, of Peoria, was chairman, had spent much time in investigating the license laws of other states, presenting a proposed form to the local associations for criticism and trying to embody these criticisms so far as possible.

Provisions of the proposed law are that the governor, with the approval of the senate, shall appoint a chief examiner who in turn shall appoint 10 district examiners, 1 from each district and not more than 5 from any political party. Both the chief and each of the district examiners must be a competent steam engineer who has had 10 years' experience next previous to his appointment, and he shall hold office for 4 years, giving his whole time to the work. The office of the chief examiner shall be in Springfield in the State House, and he shall have a clerk at a salary of $1000 a year to keep records and assist in handling the office work.

Salary of the chief examiner will be $2400 a year and of each district examiner $1500, all necessary traveling expense to be paid. Bonds shall be given by the clerk, chief examiner and district examiners, and salary and traveling expenses are to be paid from the state treasury from any funds not otherwise appropriated. The law is to take effect 60 days from date of passage and requires that all boilers of over 5 hp. except heating boilers and all engines shall be subject to its operation. No plant may be operated without a licensed engineer nor may any person without a license operate a plant.

Licenses may be revoked for sufficient cause and re-examination may be asked for by a rejected applicant, the second examination to be conducted by a board of 3, 1 appointed by the applicant, 1 by an examiner and the third by these 2. The state examiner who acts on this board shall be some other than the one making the original examination.

Railroad locomotives are exempted from the action of the law and traction engines take a special traction license. There was some question as to the amount of the license fee, as all grading of licenses was eliminated by the action of the convention, but the probability is that there will be a fee of $2 for the granting of the license and $1 for yearly renewal, the renewal to be made within 30 days from expiration of old license or else a new examination must be taken.

Provision is made that any engineer who has been operating a plant 3 years or over, on certificate of his employer that such operation has been entirely satisfactory shall be granted a license for that plant, and those engineers who now hold a license from a city board of examiners shall be granted state license in place of the city license without examination.

Violations of the law are punishable by a fine of not more than $50 or imprisonment for not more than 30 days.

The chief examiner must report yearly to the governor all accidents, examinations of engineers, receipts from fees, expenditures and recommendations with regard to the operation of his office. In making examinations the district examiner is to give notice in newspapers of the time when he will be at a given place for making examinations and is to send word to all applicants for examination of the times when they are to appear.

In making an appeal from the decision of the examiner it must be made within 10 days from the date of the examination and not later than 90 days from such date. New examination will then be held within 5 to 40 days from the time of this notice, and if the decision goes against the applicant he may not apply for another examination for 90 days afterward.

In case of resignation of an engineer a plant in a remote district where another engineer is not easily secured may be operated for 4 weeks by a nonlicensed operator whom the owner of the plant believes to be competent. A man in charge of a boiler which is not under the direct supervision of a chief engineer is to procure a special water tender's license. Owners of traction engines are obliged to notify the chief examiner by the first of July in each year what engines they have and where they are located, and the operators of such engines must be supplied with traction engine licenses.

As it stands, this law, while working hardship to no one, would make for safety and for the economical operation of power plants. Competent men would be placed in charge of plants, men who would look well to the proper condition of their machinery and who would have the knowledge needed for getting the best results from their plants. It would place the engineers of the state on a higher level and as a result

would better their condition both socially and financially. It is worthy the support of every engineer and power plant owner to secure its passage.

Officers' Reports

CONTINUING the business of the convention, the secretary reported a gain of 15 per cent in membership of the state organization and 20 per cent in the cash in hand. Some discussion was aroused over the amount of the per capita tax and it was finally decided that the tax collected should be 10 or 20 cents a year, according to the discretion of the treasurer and the needs of the association.

In the report of President Reynolds, of Peoria, recommendation was made that a delegate to the state convention be allowed for every 25 members or majority fraction of a local association, that 2 days be taken for the work of the convention and that the convention go on record as favoring biennial meetings of the national body and a per cent of the money so saved be devoted to educational work and assisting the local associations throughout the country. These recommendations were all adopted.

The next convention is to be held on the third Friday, Saturday and Sunday of May, 1911, and a later vote of the convention determined the place as Ottawa.

It was voted that the convention should request local associations throughout the state to instruct their delegates to the national convention in favor of a biennial convention and that recommendation for the biennial convention and the use of 50 per cent of the receipts in the off year for educational work be made to the national convention. Also the secretary was instructed to communicate this decision to other state associations and request their co-operation.

New Officers

ELECTION of officers for the ensuing year resulted in the choice of W. L. Parker, of Elgin, as president; John F. Alt, of Ottawa, as vice president; W. E. Hill, of Moline, re-elected secretary-treasurer, and A. E. Reynolds, of Peoria, state deputy. Officers were installed by Past State President F. W. Raven, and resolutions of thanks were passed to the city of Moline, the firms who had contributed to the success of the convention, and the members of the local committee and of the local association for the hospitality extended to the delegates and visitors.

EXHIBITS

ONE of the most important exhibits which a company has at a convention is the representative sent there. As a rule this part of the exhibit seen at conventions is one of which the company represented may be proud. The few exceptions are, therefore, all the more prominent and cause wonder whether the companies represented are aware of the kind of representation that they are getting.

Material exhibits are always interesting and receive the attention which they deserve. The booths provided at Moline were tastefully decorated and gave good opportunity for the display of apparatus.

THE LUNKENHEIMER CO., which was in charge of E. P. Gould, of Cincinnati, showed a full line of its brass goods and high grade engineering

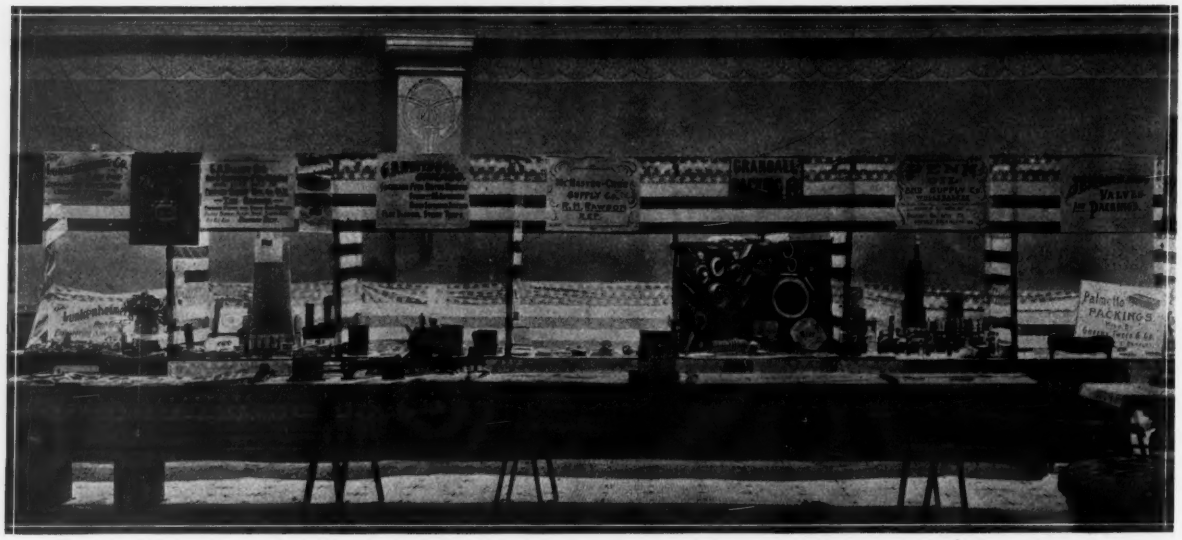


FIG. 2. EXHIBITS AT THE ILLINOIS STATE CONVENTION

specialties, emphasizing particularly the "Renewo" valve and the disk which gives it its name.

GEO. B. CARPENTER & CO., of Chicago, was represented by C. A. Elliott, and besides samples of the Peerless spiral and rod packing, Rainbow sheet packing and Eclipse gaskets, showed other products of the Peerless Mfg. Co., for which Geo. B. Carpenter & Co. is western agent.

C. B. WHITE & CO., of Chicago, was represented by Mr. White and in its exhibit space was shown descriptive matter covering the Cochrane heaters, steam and oil separators and water softening systems made by the Harrison Safety Boiler Works, the apparatus of the American Regenerator Co. for utilizing exhaust steam, the Sorge exhaust head, and pamphlets on the Experience of a Drop of Water, and Separator Talks.

McMASTER-CARR SUPPLY CO., of Chicago, was represented by R. H. Rawson, of Peoria, and showed literature describing the Austin steam and oil separators, Wright steam traps and safety water columns, economy valve reseating machine, Curtis specialties made by the Julian d'Este Co., Ashton valves, White Star oil filters and oiling systems, the Canton-Hughes pump, the Foos gas engine, Martel metallic packings of the split ring type, the Monarch combination back arch and Durabla sheet packings.

CRANDALL PACKINGS were well illustrated by 2 sample boards and some miscellaneous samples. The standard and wedge form packing rings and gaskets, sheet packing, pump valves, perpetual metallic ring packings were among those shown. Representatives were Francis M. Wheeler and G. W. Anderson, of Chicago.

GREENE, TWEED & CO., manufacturers of Palmetto packings, were represented by F. E. Ransley, of Chicago.

THE ANCHOR PACKING CO., of Philadelphia, had at the convention J. R. Menish, of Chicago, to look after its interests.

PENNSYLVANIA REFINING CO., of Oil City, Pa., is an independent concern, making a specialty of all kinds of oils and greases. The Pennsylvania Oil & Supply Co., Ltd., which is its representative in the Central West, showed a large and interesting line of the different kinds of oils and U. S. Wilson, of Davenport, explained the methods of manufacture and how the different lubricants are adapted to different uses.

HAWKEYE BOILER COMPOUND was kept in evidence by means of souvenirs and blotters, by John L. Clark, of Chicago, Theo. Brommelschinkel, of Aurora, and R. M. Rochfort.

DEARBORN DRUG & CHEMICAL WORKS sent its Illinois standbys, J. G. Beckerleg, without whom no convention would be more than half a convention, O. E. Poole, of Peoria, and E. P. Poole, of Peoria, and F. C. Gibbs, of Davenport. Engineers and delegates were favored with bill folds and in the evening all at the banquet tables were provided through the courtesy of the company with bottles of choice perfume.

REPRESENTING THE Garlock Packing Co. was A. F. Mayers, of Chicago.

AN INTERESTING LIVING MODEL was that of the Lyons Boiler Works, of De Pere, Wis. W. P. Lyons, in charge, kept the glass shell boiler, which illustrates the rapid circulation and high steaming capacity of the boiler, in operation for the instruction of visitors and was rewarded with interested attention at all times.

THE HARRISON SAFETY BOILER WORKS sent Geo. M. Massen, of Streator, as its representative.

HARTFORD STEAM BOILER INSPECTION CO. was represented by Arthur Brodt, of Davenport.

ALTHOUGH it had no exhibit, Keystone Lubricating Co. was well represented by Henry Helms, of Milwaukee, and F. W. Armstrong, of Chicago, who kept the convention properly lubricated and in good spirits.

GEO. W. LORD CO. sent from Philadelphia Wm. G. Townsend as representative to the convention.

JENKINS BROTHERS, showing its Jenkins valves and '96 packing, was represented by H. B. McLelland with an interesting series of pamphlets and catalogs.

H. W. JOHNS-MANVILLE CO. had active representation by Jos. H. Campbell, of Chicago.

QUAY T. STEWART, of Chicago, represented the Western Valve Co.

NATIONAL ENGINEER was represented by the general manager, Robt. T. Larkin, and by Editor John W. Lane.

EVERY RIGHT ACTION and true thought sets the seal of its beauty on person and face.—Ruskin.

WITH THE PENNSYLVANIA ENGINEERS AT SCRANTON

IT rained; and then it rained, which was a cause of much inconvenience and discomfort, but afterward it cleared off, and Saturday it was pleasant, which made up somewhat for Friday's lack of foresight. The International Correspondence Schools did everything they could and we suspect that, if the weather department had only taken a proper correspondence course, it would have been able to make better weather for the days of the State Convention.

The exhibition was good and it was the fault of the weather that it did not have better attendance, but the work accomplished by the meetings at the convention was satisfactory in spite of the weather. E. J. Clarke, chairman of the local committee, called the meetings to order on Friday morning and welcoming the delegates expressed regret that all associations were not in the State Association. He introduced Wallace Moser as representing Mayor Von Bergen, and Mr. Moser extended the usual freedom of the city, complimenting the association on its aims and what it has accomplished in the last decade for engineers.

S. B. Force of Pittsburg, being introduced by Mr. Clarke, stated, for the benefit of those not members of the association, what its aims and objects are and the extent of the association. The work of the International Correspondence Schools was then outlined by Mr. Clarke, who introduced T. J. Foster, founder and proprietor of the schools. Mr. Foster spoke in part as follows:

Mr. Foster's Address

NOW I came here to spend a half hour with you and to have a general talk on the subject of education, because this is the underlying basic principle on which your organization is built.

"I have the highest opinion of the N. A. S. E. and I know something about its history. I came in contact with it when it was a very young organization.

"We started this correspondence school in 1891, and for the first year we were engaged in teaching mining subjects. The school was the outgrowth of the necessity to educate miners to positions as mine foremen.

"The truth of the matter is that if a man wishes to work and operate mine machinery he has got to know as much mathematics as he is required to know to be a mechanical engineer. Now the thing was how to get this into the people's heads. So I undertook to do it in this way: In the columns of the paper I was publishing I inserted exercises on Arithmetic, Mensuration and Formulas and then answered them myself. I worked along in this way a few years until finally I conceived the idea that we could start a course by getting up special instructions and question papers, and in 1891 I moved to Scranton and started the Course in Mining.

"I thought we could teach men Arithmetic, Mensuration and Formulas by correspondence, but I hadn't any idea we could teach a man to run a surveying instrument or map by correspondence, but we hadn't gone very far until we found there was a necessity to do that. We arranged that every man who bought a scholarship could have the privilege of coming here in the summer and spending 4 or 5 months in order that we might teach them to map and use the surveying instruments. We found that only a small portion of the men could leave their work to do this, only about 20 or 30 or 40 men, and so it became necessary to teach them to map by correspondence. Having found

that we could teach them to use the compass and transit by correspondence, we thought we could teach Mechanical Drawing and we were successful in that also. That led us to the teaching of the mechanical subjects. Two or 3 yr. passed and in 1893 we were teaching stationary engineering.

"The N. A. S. E. had been organized about 10 yr. before, and the officers of the Association thought they could get up a plan to teach its members the principles of Arithmetic and Mensuration by papers of instruction, which they could use for blackboard work in the lodge rooms afterwards.

"Our bids were accepted and we furnished the instruction in the subjects mentioned. I am not familiar with the plans that are in use now, but I will say here that if we could conceive a plan whereby you could use our work, I think it would be a good thing for both of us.

"Some things have recently occurred that might give us ideas for a basis to work on. The Lehigh Valley Coal Co. advised us that they would like to cooperate with us on a plan that the superintendent had in his mind which he thought would be advantageous to the men and we finally tried the experiment. They rented a room in a little town 3 miles west of Shenandoah, fitted it up as a school room, and had 4 sessions a week, 2 sessions of which were attended by boys such as door boys, apprentices and drivers, and the other 2 sessions were given over to the men. They took our instruction papers and employed a teacher to instruct them, and the result has been most gratifying. Last year they had 100 students and they did more studying than any other similar class of 100 men anywhere in the United States. This same plan was followed at Centralia and the superintendent stated that 20 per cent. of the students had made such progress that they had been able to give them better jobs and some of them were promoted to the position of assistant foreman. This movement has attracted the attention of coal operators all over the United States.

"Now we have much experience in teaching steam engineers. We have enrolled up to date in the Steam Engineering Course 116,400 students. An examination of our records will show wonderful results. One thing is to buy a scholarship and another thing is to study it. The great trouble is to get students to study. Our work may be divided into 3 distinct parts. First, the preparation of textbooks. We prepare our textbooks so that a man who has had no preliminary education can understand them. The idea is that these will cover every subject in his course and provide all the preliminary knowledge he needs in order to study and understand the work. Then, secondly, we render assistance to those requiring it and examine and correct the work of students. Special instruction is also given wherever it is necessary to do so.

"But we have something else besides. This would not be the great institution it is if it was not for its inspirational work. This is to induce men to study. This inspirational work is our principal business. If we can get men to study, there is no trouble in collecting the money, but if they won't study, then it is difficult to get the money. There is about 65 per cent of every 100 enrolled that persevere in any degree with their work.

"You know that an institution like this cannot be maintained except at a great expense. It costs 1/3 of what we receive from every scholarship to pay the expense of enrolling the student. We have throughout the country about 1600 men who do nothing else but work on a salary and commission basis to get students.

"The most important thing is to make students. If we can make a student, as a rule, we can make a successful man.

"Out of 1015 enrolled in the Steam Engineering Course 312 became chief engineers. Six hundred and eighteen out of the 1015 became stationary engineers.

"The most important thing a course of instruction can do for you is to make a man of you. The most important function of education is to make men, and this important function is almost entirely lost sight of by the colleges and regular educational institutions. The important thing is the habits a man forms. The habits he forms in connection with the taking of a course of instruction, if there is anything in him at all, are bound to make a man of him. As you go over the papers, and as you complete subject after subject, it gives you confidence in yourself.

"It gives you self-reliance, and that, in my judgment, is the keynote of success. If a man has con-

ENGINEERS AT THE PENNSYLVANIA CONVENTION

fidence in himself and thinks he can do a thing, why 9 times out of 10 he will succeed. Look at our great business men, the people who have accomplished great results. They had sufficient confidence in themselves to undertake the work and they won out. I think that one of the greatest advantages a man gets by studying is the confidence he gets in himself. A great many of our students advance because of that fact.

"As a matter of fact you can pick out students who haven't been successful and you will find that they are pessimists. Some men are born pessimists. They never see the bright side of anything. They do not believe they can be successful. It doesn't make any difference how much you educate a man like that. If a man has ordinary intelligence and will form the study habit, he is bound to succeed.

"Good health is also essential, as a rule, to success. A man may be industrious, but he cannot be vigorous —he cannot be energetic unless he has good health. If a man is born with a fair constitution, and if he has good sense enough to live in a right manner, and will form habits for study, the chances for success, in my judgment, are 90 out of 100.

"A man must also have self-confidence in order to succeed. If you are going to do a thing you need to think seriously about it and concentrate your mind upon it. If you cultivate the habit of thinking seriously you will be surprised at the results you will accomplish. When you put your mind on an enterprise seriously, you will see the difficulties attending it and the ways of accomplishing success, which you would not see if you hadn't centered your mind on it.

"As a matter of course, if a man studies, he learns to be industrious. All these things are habits. Character is simply a chain of habits. If a man has a will he can make himself a strong man by simply cultivating the proper habits. While you are studying you are involuntarily forming habits that stand for the things that accomplish success. I believe the day will come when in all the great colleges of the country the most important work will be to make men.

"I believe that in the evolution of this organization, the N. A. S. E., you will come to see these things just as I see them, and that you will be claiming before long that the most important thing is to make first-class men.

"The textbooks we use in Steam Engineering have cost our company $200,000. We have gentlemen in the institution who for years have done nothing but make a study of the principle that will make textbooks reasonably understood by the man who has not had previous training, and we do, I think, use the best textbooks that are published. This is evidenced by the fact that we sell them to colleges and they use them for post-graduate courses. They use them because they are practical.

"The most important work we do is to induce a man to study. It is so important with us that we never stop a man from studying because he does not pay. We never compare the financial records with the educational records. It would cost us more than it would be worth, if we tried to compare these records. I have known men who have become stationary engineers who paid only a small portion of the price of their course and completed the work, and we couldn't get the money out of them. But when it came to giving them a diploma, we wouldn't furnish a diploma until they paid.

"Now, if a man enrolls and pays $10 or $15, his name is never wiped off the rolls, and we do not know but that he may complete the course without paying a cent more, or he may not study at all. But, if he doesn't study, it is not our fault, as we have given him the opportunity.

"Now, don't take this as an advertisement for the International Correspondence Schools. It is not intended for such, but I want to say to you that I will heartily co-operate to improve methods of teaching, and I will do that, too, without the hope of special benefit to us, because I think anything we can do to improve the N. A. S. E. helps our business and it pays us to help such undertakings and efforts."

Following Mr. Foster's speech, State President John M. Lynch of Erie spoke at length of the educational work of the Association and of the wide range of subjects which is covered in the meetings during a year in the home study lessons and of the prizes offered for the best answers. Committees were then appointed and the convention adjourned until afternoon.

At the afternoon meeting President Lynch in his annual address expressed his dissatisfaction with the lack of support of the State Association by the subordinate associations. He advocated raising of larger funds for the work of the license law committee, and questioning whether it might not be better to have the convention biennial, saving something like $20,000 to be expended in the educational work of the association.

He advocated also the equipment of association rooms with testing instruments and models for the study of engineering problems. He emphasized the desirability of state representation at the national conventions and was inclined to favor representation at the national conventions from the state organizations instead of the local associations. He suggested the appointment of a Board of Boiler Rules to consist of 5 members, similar to that which has so satisfactorily codified boiler practice in Massachusetts, and also suggested a state convention for 3 days to give time for examination of the exhibits and for lectures and discussions on engineering topics.

The treasurer's report showed a balance on hand of $241. Discussions on the conditions of license laws brought out the fact that there was some difference of opinion as to the form of the law. The law as reported by the license committee was finally referred to a committee of 5 appointed by the President and the matter was laid over until Saturday.

At the meeting on Saturday morning the first order of business was a paper on Combustion of Coal by E. A. Wildt, chief engineer of the Scranton Railway Co. Mr. Wildt stated that when burning small sizes of anthracite or any fuel which masses on the grate, it is necessary to use forced draft and presented argument in favor of the steam blower on account of the heat generated in burning the hydrogen from the decomposed steam, and the prevention of the formation of clinkers. This method also for small anthracite gives purer coal, for the slate does not break up so much as does coal, hence does not get into the smallest sizes and screenings.

The secretary's report showed 11 associations in good standing and a gain of 21 members during the year. It was then found that on referendum vote the constitution had been changed to make the object of the state association the benefit of local associations and the promotion of license law. The license law was then taken up and was adopted, the following provisions being the ones approved by the convention:

All engines, except those below a certain horsepower, of which the amount is to be determined later, and all boilers carrying more than 15 lb. per square inch must be operated by licensed engineers. Also,

boilers and engines under the control of the United States and locomotives operated by railroad companies are exempt. The committee was instructed to keep the limit within 15 hp. if possible.

The chief examiner is to be appointed by the governor and approved by the senate and must have not less than 10 yr. practical experience and may hold office for 4 yr. The state is to be divided into 6 districts and a district examiner for each district appointed by the chief examiner. The district examiner must have had 6 yr. experience and sufficient knowledge to properly conduct the examination of engineers. The chief examiner is to hear appeals from the discussions of district examiner, to keep records of his work, for which a clerk shall be furnished him, and to have charge of the district examiners.

He may be removed for special cause by the governor. Those engineers who have had charge of steam boilers or engines for 3 years immediately prior to application for license shall be granted a license without examination. License may be refused on the grounds of intoxication, neglect of duty, or insufficient knowledge, and license may be revoked for intoxication or neglect of duty. The license fee to be $3 and renewal fee $1, this renewal to be taken out within 30 days of expiration or the full license fee must be paid.

Salary of the chief examiner to be $3000 a year, of the examiners at Philadelphia and Pittsburg $2000 a year, and for each of the other 3 examiners $1500 a year, also the traveling and office expenses of each examiner as well as the salaries to be paid out of the general revenue fund. The clerk of the chief examiner to receive $1200 a year.

The chief examiner to give bond for $10,000, the Philadelphia and Pittsburg examiners $6000 each, the other district examiners $4000.

Operating of a boiler or plant by an unlicensed engineer after a space of one week from notification is to be a misdemeanor, punishable by fine of not less than $5 nor more than $50, for the person so operating and from $10 to $200 for the firm so operating. Each day's violation constitutes a separate offense. No owner may place in charge to operate any steam boiler or engine for more than 10 days a person not holding proper license, and violations of this provision are punishable by fine of not more than $100 and an engineer acting without license shall be punished by fine of not more than $100 or imprisonment of not more than 3 months, or both.

The necessity of getting into touch with state representatives and urging on them the passage of the state license law was also emphasized.

The recommendations of the president as stated in his annual address were referred to the subordinate associations for referendum vote.

Election of officers was then taken up and resulted as follows: President, F. M. Zimmerman, Pittsburg; vice-president, E. J. Clarke, Scranton; secretary, A. C. Cotton, Pittsburg; treasurer, D. E. Seeley, DuBois; conductor, W. D. Orms, Johnstown; doorkeeper, E. E. Livingstone, York.

Johnstown was chosen as the convention city for 1911.

The new state officers were installed by Samuel B. Forse, past national president, Richard Pape acting as conductor, and thanks were voted to the local committee for its excellent work in arranging the program, also to the International Correspondence Schools for courtesies extended.

On Friday evening a banquet was held at the Liedercranz Hall, the usual supply of eatables and drinkables being taken care of with the greatest enthusiasm. Following this J. B. Jones of the International Correspondence Schools introduced National President Reynolds, who spoke of the meetings of the state associations and the necessity that all locals should be members in order to get the best results. Also the help that engineers in the large cities ought to give to those in smaller towns by assisting in the passage of state license laws.

After songs by Herbert Self of the Peerless Rubber Co., National Treasurer S. B. Force was introduced and spoke on the value of a Ladies' Auxiliary. Songs by Joseph McKenna of Jenkins Bros., and afterward State President Lynch voiced the appreciation of all visitors of Scranton hospitality, and mentioned a boiler inspection law as the next step after the license law.

F. J. Corbett of Manning, Maxwell & Moore favored the audience with songs, and Past President Joseph Kearney of New York spoke of the good condition of the Pennsylvania State Association and the enthusiasm manifested at the present convention.

Billy Murray of Jenkins Bros. rendered several songs, after which Past President Garlick spoke on the topic of "Good of the Order," and interpreted this to be a good laugh which he secured by telling of good stories. Jack Armour of the Hill Publishing Co. gave a series of humorous "odds and ends" which were received with the usual appreciation of whatever Jack does.

EXHIBIT HALL FEATURES

BEAUTIFUL and convenient arrangements were made in one of the large halls of the International Correspondence Schools for both exhibits and convention meetings. Plenty of booth space, plenty of light and plenty of shelf room made an ideal place for showing goods, and exhibitors owed a vote of thanks to Mr. Evans and the schools for their efficient work.

THE INTERNATIONAL SCHOOLS naturally made the largest exhibit as the whole plant for printing, teaching, preparing papers, models, and shipping were on display. And the 1500 employes engaged in instruction work were certainly most impressive evidence of the popularity of this great educational movement. In the hall special exhibits were made of the reference library furnished to students, some of the models used in the preparation of papers and illustrations, drawing instruments and supplies used in the "salary raising training."

J. H. WILLIAMS CO.'S working model of how a Vulcan wrench "bijaws" a pipe was a drawing card, and fastened attention on the "Vulcan," "Agrippa" and Williams tools, especially those for pipe fitting and automobile repairing.

DEARBORN DRUG AND CHEMICAL WORKS was assigned a booth, but made no special exhibit.

CHAS. B. SCOTT CO. of Scranton represented a large line of steam specialties. At one end was a large American Steel Pulley and at the other a wood split pulley. Steel Mill Metallic Packing was an interesting feature and was surrounded by Bashlin valves, Hyatt roller bearings, Trimo wrenches and tools, Wright wrenches, samples of camels hair belt and was flanked by a pyramid of Keystone grease. P. W. Werth and Clinton H. Brown "poured."

N. B. O. Sheet Packing and Triumph Rod packing formed part of the exhibit of the Bittenbender Co. and Dick Foley was in special attendance for the Home Rubber Co.

STRONG STEAM SPECIALTIES, traps for pressure and vacuum and separators for steam and

oil were also in the Bittenbender exhibit, with Homer Welpley in charge.

LIBERTY MFG. CO. was unlucky in getting its exhibit too late to use, but "sent its card" in a big sign.

AIR COMPRESSORS and drills were the subject of the Ingersoll-Rand Co.'s display of catalogs and prints in charge of J. C. Gillies of Philadelphia.

WILHELM-RIVENBURG CO., of Scranton, representing the Diamond Rubber Co. and the Wyckoff Wood Pipe Co., showed Indian Red and Volunteer sheet packing, Titan hose, pump valves, wood covering for underground pipe and Star belt dressing, this last made by the Globe Boiler Compound Co. of Binghamton, N. Y.

JENKINS VALVES, '96 sheet packing, Jenkins disks and gage glass mountings gave evidence of the quality of goods listed in the handsome Jenkins Bros. catalog. Frank Martin and J. C. McHugh were the library of reference on Jenkins products.

CLING SURFACE clung well and the model proved it; for it showed how much greater pull can be had from a loose belt with good Cling Surface than from a tight one without. And think of the saving in bearing strain. Chas. F. Chase and C. N. Tillotson "made the model talk."

LINDSTROM STEAM SPECIALTIES included the Corliss valve steam trap, steam separators and oil separators made by the Lindstrom Machine Works.

C. W. DIBBLE, Jack Armour and Van Kleek represented the Hill Publishing Co.

GARLOCK and No. 900 fiber sheet were among the features of the packings exhibited by H. W. Gulager in the interest of the Garlock Packing Co.

HUHN METALLIC PACKING was shown by Macan, Jr., Co., of Scranton, in the interest of the American Huhn Metallic Packing Co. Also were shown the Lackawanna grate and blower, the everlasting blowoff valve, and Northern Steam Specialty Co.'s safety water gage.

ASHTON SAFETY VALVES, water relief valves, pressure gages with 1 or 2 springs, testing outfits, recording gages, and the Ideal alarm gage in an operating model were well displayed for the Ashton Valve Co. by Chas. Leo Buckman, of Boston.

LUNKENHEIMER brass goods always show up well and in this exhibit Ford & Kendig, the local representatives had placed globe valves for steam with the renew disk, ammonia valves, and brass specialties in great variety.

RAINBOW WAS AT THE FRONT, in the navy as well as the exhibit. It's the sheet packing which the Peerless Rubber Co. furnishes Uncle Sam for his ships. And the Eclipse gaskets and Honest John spirals made brave setting to the Rainbow rolls. J. W. Garrett and J. S. Edwards did the job.

THE KEELER water tube boiler and grate bars made by the Valley Iron Works, were well illustrated in catalogs, blueprints and photographs by E. Keeler Co.

IDEAL PUMP VALVES and plunger packing is a new product of the Lake Erie Boiler Compound Co., shown by L. U. Benjamin.

W. B. McVICKER CO., specialists in boiler compounds were represented by G. Frank Duemler.

CONTINUOUS RECORDS taken with the Trill indicator, and the Trill, which does the trick, were the exhibit of the Trill Indicator Co.

LAGONDA AND WEINLAND specialties make good boilers work better, as was explained by Hart Hill of Philadelphia and C. F. Overly of Pittsburg at the stand of the Lagonda Mfg. Co. The motor driven reseating machine, the Weinland cleaners and heads, the Lagonda automatic cutoff valve and the special device for cleaning Stirling boilers are some of the helps.

PRACTICAL ENGINEER'S premiums are astonishing value, as proved by the two years' subscription and Swingle's Twentieth Century Handbook offer made at the convention.

GREENE TWEED & CO. make Palmetto packings and are glad to show them in twist or other form; also Manhattan packing for elevators and hydraulic work and Greenet for gasket tubing. The Favorite reversible ratchet wrench was a real favorite with engineers, and justly so. B. M. Bulkley helped make it so.

NEW JERSEY ENGINEERS

STATE CONVENTION AT JERSEY CITY JUNE 4 AND 5

EVERY local association in the state represented and a member of the state body. That was the proud record made, and tells the story of hard, successful work and an enthusiastic meeting.

As to the detail of what happened, why F. A. La Pointe, chairman, called the meeting to order and welcomed the state, and then President Arthur L. Case of Plainfield appointed his committees, officers made encouraging reports, interesting speeches were made, good plans laid out for future work and an enthusiastic set of officers put in charge for next year.

Secretary J. J. Reddy showed that there were 53 delegates seated, that 10 associations with 854 members were enrolled and that the increase was 169 members during the year.

Treasurer James Durkin showed an increase in net finances with $95 on hand and all debts paid. E. A. Sears, vice-president, told of visits paid to all associations in the state and the arousing of some so that all are now active and vigorous.

President Case called attention to this as the 19th meeting, New Jersey being the first and oldest state association, and urged that all avoid ruts, keep the date and place of meeting prominently advertised and make much of the social and fraternal features. He also advised that request be made for recognition and representation of the state bodies in national conventions and for control of certain features of local work by the state associations.

Cigars for the session were supplied by Greene, Tweed & Co.—the meeting fired up with celerity. Invitation was received to visit the new plant of the three million dollar court house and "old Bill Cronley" told of some experiences in "firing" among the Sioux Indians in the '50's.

State Deputy Coe of New York spoke of license progress, of the overcoming of the opposition of the large cities and of the need of more traveling among local associations, for which the national association might well supply funds.

Other speakers, Past President Savage, Messrs. Johnson of Paterson, Shortman of Newark, Carberger of New York and Stone of Boston emphasized the value of the social features, of state oversight of locals and of getting all locals into the state association. H. E. Stone spoke, particularly, of the high standard which engineers should set for themselves and the high value they should put on the profession as to character of men and attainment in knowledge.

The Banquet

WHY do mayors always delay things? It's about time that some remedy was devised for the late mayor nuisance and meetings started on time regardless of the failure of such dignitaries to meet appointments. If a man is unavoidably late, he will feel much relieved to find things going on smoothly when he arrives; if he's careless, he deserves to be snubbed. An engineer is as good as a mayor any day, and what if, sometime, a mayor got huffy and didn't drag out the mushy, motheaten old myth about the "freedom of the city"? The standing of engineers will not be hurt by the omission even if all at the meeting had to behave as well as the rest of the community.

The dinner was fine, when it got started (a case of late mayor who sent a substitute after all), and the singing and speaking were a match for it.

Past National President Stone reviewed the work of the N. A. S. E. Judge Robert Cary gave interesting incidents of experience as a stationary engineer in running a motor boat and got right at the meat of the use of associations by showing the duty of engineers and all others to uplift themselves and their vocations for the sake of doing something worth while and helping their fellow men. That's the reason for conventions and associations and is what justifies them.

Progress of responsibility, outlined by Fred L. Johnson, included the rise in steam pressures, increase in size of units, and complication of machinery. Duty in regard to conduct at meetings, making the most of opportunities, work for license and for inspection laws, and attention to obligations as a citizen were dwelt upon interestingly.

Growth to the top and co-operation was the theme of Commissioner Bierck; the importance of the heating and ventilating of schools, that of E. A. Murphy; progress of state associations, that of National President Reynolds; connection of engineers and electricity, that of Prof. A. A. Adler, and an engineer's duties, that of Dr. M. Lampson.

During the evening songs were interspersed by Joseph McKenna of Jenkins Bros., Frank Corbett of the Ashton Valve Co., Billy Murray of Jenkins Bros., and Jack Armour of Hill Publishing Co.

License Laws

NEW Jersey has a special license law allowing of city ordinances for engineers' licenses and the larger cities are now operating under such ordinances. Effort is, however, to be made to get state license for the sake of giving protection to small as well as large communities and the committee was increased from 3 to 5 members and a fund raised for the work by voting a tax of 25 cents per capita.

Recognition of state associations was endorsed and delegates asked on the basis of one to each 200 members of subordinate associations in good standing in the state association.

Officers

PASSING to the final business, Arthur L. Case of Plainfield was elected state deputy; Edward A. Sears of Newark, president; W. Crouse of Passaic, vice-president; J. J. Reddy of Jersey City, secretary; James Durkin of Hoboken, treasurer; P. J. Tulley of Newark, conductor; and F. B. Arner of Perth Amboy, doorkeeper.

Newark's invitation for the 1911 convention was accepted and a vote of thanks tendered Jersey City association for the entertainment furnished.

Officers were installed by National President Reynolds, Past President Callahan acting as conductor.

SUPPLIES AND SUPPLIERS

YES, John Foote was there, also John's son, John Foote, and Frank V. Tuthill, all made of Steel Mixture, and all good representatives of McLeod & Henry Co. The boiler model showed how to use Steel Mixture for furnaces and back arches.

GRATES TO SHAKE and dump, both Empire and Imperial types, and an Argand model Economy steam furnace blower, were the features of the Donegan and Swift space.

BELMONT? Certainly, the packings made by the Clement Restein Co. and displayed by A. H. Foster of the New York office. All sorts for all services; square, round, sheet, spiral, wedge, ring and combination.

THEY'RE STARS, the Powell valves; White Star and others; renewable disks and the reseating device make them handy and nearly everlasting. H. Mueller Mfg. Co. was exhibiting them for the William Powell Co.

IT'S A GREASER, that cylinder lubricator which the Ohio Grease Lubricant Co. showed; uses grease instead of oil and the witnesses testify that it does the business. Greases and commutator compound are also supplied. And the Mutual Supply Co., which arranged the exhibit, showed also the Roto Tube Cleaner, which is another "get there" device made by the Roto Co. of Hartford, Conn.

"HOT STUFF" is what the Yingling double acting eccentric motion shaking grate is said by C. Yingling & Son to produce. The swastika sign was an attractive arrangement of the exhibit.

THOSE ROBERTSON-THOMPSON indicators which Jas. L. Robertson & Sons showed and the complete outfit made one want to take it right home and get at setting the valves. And the Eureka packings looked good to keep the joints tight too.

IT LUBRICATES, Keystone Grease, and R. D. Jackson of the New York office of Keystone Lubricating Co. was there with samples to prove it, and to cap the top story of all comers with a Keystone lid.

PRACTICAL ENGINEER'S special Big Value offer attracted a lot of the delegates. It was too good to leave.

LUNKENHEIMER force feed oil pumps, grease cups, oil cups, lubricators, gage cocks, whistles, relief valves, quick closing gate valves, straightway blow-off valves—these are some of the interesting specialties arranged by W. A. Reynolds and J. E. Cooper.

JENKINS BROS., represented by Frank Martin, Joseph McKenna and Billy Murray, emphasized the good old standbys—'96 sheet packing, Jenkins valves and disks, and tubular gaskets. "Windows" cut in the valve bodies to show disk and seat construction added to the interest of the diamond trade mark apparatus.

THOSE FLIES were not on the N. B. O. packings of the Home Rubber Co., although they were in charge of R. Valdespino, its representative.

RIGHT IN THE CENTER, Paul L. Crowe showed a real chain grate with easily removable grate bars, each one piece across the furnace, carried by heavy link chains whose passage over the guide wheels gives a vertical vibration to break up clinker and masses of bituminous coal.

ASHTON SPECIALTIES of the Ashton Valve Co. were represented by C. W. Ulrick.

AMERICAN BALL ENGINE interests were looked after by Harry J. Marks of the E. P. Hampson Co. of New York.

CALIFORNIA STATE ASSOCIATION CONVENTION

FROM May 23 to 28 the engineers of California were gathered in Los Angeles for the Seventh Annual State Convention. That the convention and exhibits were successful is putting it very modestly as several who have attended the national conventions place this on a par with many of them. The first meeting of the convention was held in the banquet room of the Angelus Hotel on Tuesday, May 24, with all the officers and 44 elected delegates and alternates present. Routine business occupied the entire morning session and after the proposed state license law was read, adjournment was taken until Thursday morning.

During the intermission the visiting engineers were entertained royally by their friends in Los Angeles. At the exhibit hall one of the largest and most attractive exhibitions of mechanical and electrical appliances ever held upon the coast was in progress. On Wednesday a balloon route excursion was taken to Hollywood, Palisades, Long Wharf, Santa Monica, Ocean Park, Venice and Redondo, where the plant of the Pacific Light & Power Co. was visited. A number of the visitors took advantage of the opportunity and went bathing at one of the beach resorts. In the evening a theatre party was arranged for the delegates and visitors by the local engineers.

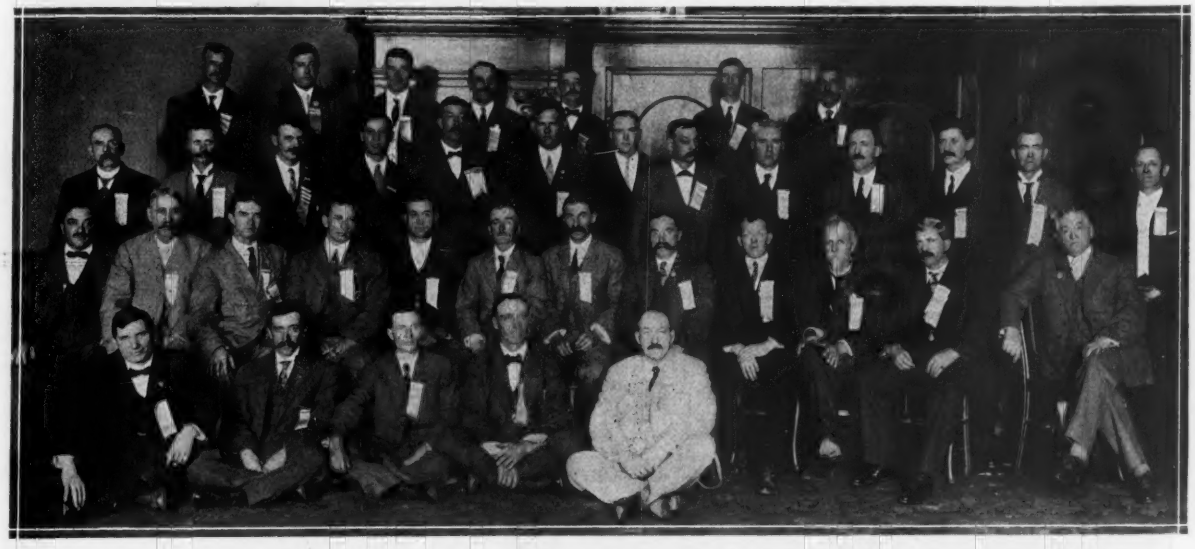


FIG. 1. OFFICERS AND DELEGATES AT THE CALIFORNIA STATE CONVENTION

At the buisness meeting, Thursday morning, the Ways and Means Committee reported favorably on the several bills and also recommended that the delegates be paid 4 cents a mile via the shortest mail route. At this meeting also, the license law was taken up by sections and discussed, passed or amended, as was also a boiler construction and inspection law, and both were referred to a committee consisting of one member from each association in the state to provide ways and means of securing

FIG. 2. GENERAL VIEW OF EXHIBIT HALL IN THE HAMBURGER BUILDING, LOS ANGELES

the necessary funds properly to place the 2 measures before the state legislature at its coming session in January, 1911.

During the business session of the engineers the visiting ladies were entertained by the Ladies' Auxiliary of Los Angeles by giving them automobile rides about the city.

Thursday evening a social dance was given at Goldberg-Bosley Assembly Hall, which was a decided success, and many availed themselves of the occasion to spend the time until midnight in tripping the light fantastic. There were about 200 couples present and would probably have been more but for other attractions which were afforded the visiting delegates.

The business session held Friday afternoon was taken up by the selection of the next convention city and after several invitations were received from different places, San Francisco was chosen. The following officers were then elected and installed for the ensuing year: Herman Noethig, San Francisco, president; David Brian, of Los Angeles, vice president; Charles Knights, San Francisco, treasurer; Wm. T. W. Curl, Los Angeles, secretary; R. S. Porter, Santa Barbara, conductor; F. W. Coombs, San Jose, doorkeeper; and J. P. Proper, Los Angeles, S. L. Riddell, Fresno, and J. N. Pyster, Santa Barbara, trustees.

A resolution was presented and adopted indorsing the proposed Panama-Pacific International Exposition to be held in San Francisco in 1915, or at the completion of the Panama Canal.

The president appointed 1 member from each association to act as an educational committee, whose duty it would be to stimulate this work in the associations and also the work given out by the National Educational Committee.

On Saturday, the last day of the convention, an excursion was conducted to Long Beach and a basket picnic was held on Pleasure Pier. The visitors were also taken to the $3,000,000 Government Breakwater and Harbor at San Pedro in the afternoon.

The banquet which was held Saturday evening was a fitting termination to the splendid efforts of the general committee to entertain the visitors and delegates. About 250 attended and the guests were given an elegant dinner, after which toasts were given by Wm. Mulholland, J. N. Pyster, A. B. Cass, H. D. Saville, W. P. Butcher, John Topham, B. F. Pearson, John Traynor, J. G. Warren and W. E. Chamberlain. Fred J. Fisher acted as toastmaster and Wm. T. W. Curl was the chairman of the occasion.

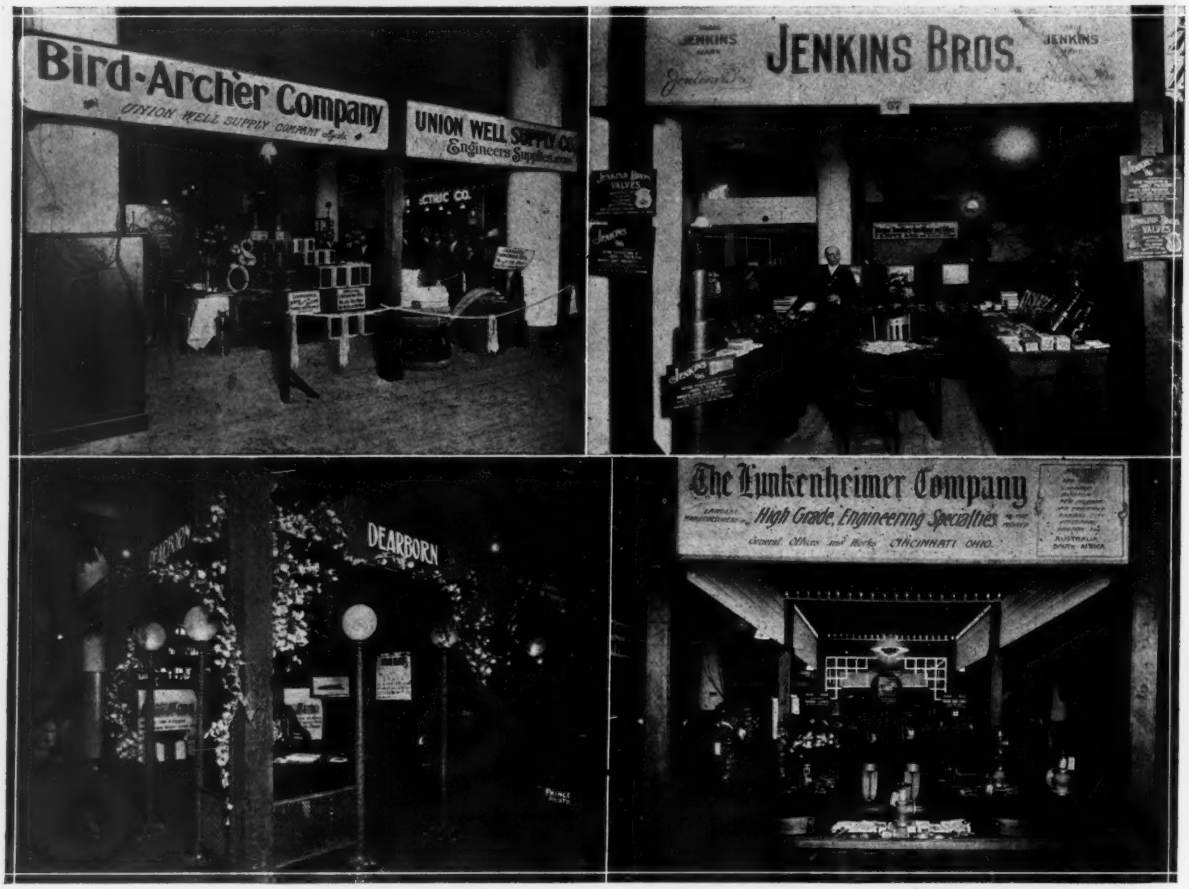


FIG. 3. BOOTHS AT THE CALIFORNIA STATE EXHIBITION

THE EXHIBIT HALLS

WHILE the incentive for attendance at the convention was the business in connection with the state association, the manufacturers and dealers availed themselves of the opportunity to place before the visiting engineers exhibits of their various products during the entire week of the convention. With the address of welcome from Mayor Alexander the mechanical exhibit was opened on the 4th floor of the Hamburger Building. Delegates and visitors from every part of California had been arriving

all day and at this meeting there were about 5000 engineers and their friends in attendance.

The exhibit was complete in every respect and well represented the activities in the mechanical line in Los Angeles and southern California. Practically every manufacturing house of consequence making machinery or products of use to the engineers had space in the exhibit hall. There were over 100 exhibitors on the floor, which covered a space of one-half an acre, and the total attendance during the week was between 60,000 and 75,000.

In the afternoon and evening of each day of the exhibit a band concert was given by Professor Shaw's Band. An attractive souvenir, containing the entire program, photographs of officers and advertisements of the exhibitors, was distributed among the visitors and delegates.

THE EMPIRE STATE CONVENTION

BUFFALO SCENES JUNE 10 AND 11

HELD amid the most comfortable surroundings with lavish entertainment, there was every reason why the 1910 convention should be a success and it lived up to its possibilities. The only criticism which could be offered was from the standpoint of the exhibitors, in that as the exhibit was in the parlors of the hotel, engineers from outside the association and who were not delegates or in attendance at the convention did not feel free to come in to inspect the exhibit, with the result that attendance in the exhibit hall was meager.

This is not a criticism of the work of the local committee, which made splendid provision for the comfort of both delegates and exhibitors, but simply a suggestion as to what makes for the best interests of exhibitors at a convention.

Opening Addresses

BOTH meetings and exhibition were held on the parlor floor of the Iroquois Hotel, the first session being called at 10 o'clock on Friday morning, June 10. Winfield Graham, chairman of the local committee, called the meeting to order and introduced Mr. Sayles, secretary to the mayor, who expressed his pleasure at being present, welcomed the engineers to the city which constitutes the western end of the "Dumb Bell" State and expressed the hope from the mayor that the stay in Buffalo would be a pleasant one.

State President Grover H. Woods put action before words, and, therefore, accepted the welcome, but said that he would reserve further remarks for the working meetings of the convention. The objects of the convention, which were especially fraternity and giving help to members, particularly the younger ones, were stated by E. P. Gilroy, of Buffalo.

Following this was National President Reynolds, who brought greetings from the New Jersey State Convention, and in his address emphasized the fact that any association is what its members make it. In order to get good from the meetings and from membership, members must attend and take part. The good member is not the one who pays his dues and never attends the meetings. Close association with other members and taking part in the discussions at the meetings is what brings the greatest benefit. The state association and national association can be strong only as members of the local association are active and interested. The local associations need, however, the state association to serve their interests in pushing for state license laws.

Past National President Herbert E. Stone called attention to the work of the Ladies' Auxiliary and to the support which it deserves because of the help that it is now bringing to disabled members of the association and the start that it is making towards the establishment of a pension fund. Mr. Stone argued for the substitution of the word "operating" for "stationary" in the name of the association, both national, state and local, and for the representation of the state associations in national convention by delegates.

The meeting was then turned over to State President Woods, who appointed committees.

Friday afternoon was given up to a trip to Crystal Beach which lasted into the evening, dinner being served at the Beach to delegates and visitors by courtesy of the Buffalo association.

Saturday morning business of the convention was taken up and reports of the officers received. President Woods recommended that the state association express itself as in favor of biennial conventions of the National Association, that state associations should have representation at national conventions and that national financial assistance should be given to local associations in the educational work. The secretary reported 27 associations on the roll with 4 others likely to be there, giving a total of 1912 members.

Proposed License Law

ADJOURNMENT was then taken until afternoon, when the license law was reported from the license committee. This law was not passed at the last session of the legislature, owing to delay more than anything else. Provisions of the law as reported and adopted for presentation to the next legislature are that all engines and boilers except locomotives operated by railroads, those under United States supervision, those under New York State supervision, those carrying 10 lb. pressure or less, and farm engines, should be operated by licensed engineers.

The chief examiner is to be appointed by the governor within 60 days after passage of the act, his term of office to be 6 years. He is to divide the state into sections and appoint a district examiner for each section. The chief examiner must have at least 10 years' operating experience as a stationary engineer and each district examiner at least 7 years. District examiners are to be chosen from lists to be prepared by the Civil Service Commission after holding examinations and are to hold office under the provision of the Civil Service Act.

Chief examiner's salary is to be $2500 and office located at Albany. He is to have a clerk appointed by Civil Service process. Salary of district examiners is to be $1800, traveling and office expenses for all examiners to be paid in addition to salaries. Chief examiner is to give bond of $2500.

To be eligible for examination as an engineer a man must have had 3 years' experience as engineer or fireman, or have served 3 years as an apprentice on construction of engines, boilers or pumps, and one year in a boiler or engine room. The rules for holding examinations and the matter to be included are to be chosen by the chief examiner. License is to be good for one year unless revoked for cause, and to be renewed without examination. Fee for examination is to be $3 and for renewal $2.

All fees are to be sent to the chief examiner by the 5th of the month and to be turned into the general fund and the chief examiner is to report all receipts by the 15th of the month to the state treasurer.

Engineers in the state now operating under license of any kind are to be granted without examination license for the same grade as now held. Others are to

be notified as soon as possible after passing of the act and to be examined within 60 days of such notification.

Appeal from the decision of the district examiner can be made to the chief examiner by paying $10 and filing the appeal. This appeal is to be heard by a board of 5 engineers, 2 chosen by the district examiner, 2 by the appellant and 1 by these four. The decision of the majority of this board shall be final. If in favor of the appellant the fee is to be returned to him. The compensation of each member of the board is to be $5 a day.

Licenses are to be graded: Chief engineer, unlimited; first-class is limited to 150 hp.; second-class limited to 75 hp. To be eligible to the first-class a man must have served 2 years as second-class and pass the proper examination. To be eligible for chief's license a man must have served 2 years as first-class engineer and pass additional examination. Third-class is a special for one plant for 30 days when the owner cannot get a regular licensed engineer.

Horsepower of boilers is to be determined on the basis of 3 hp. for a square foot of grate surface for power boilers, 1.5 hp. per square foot of grate for heating boilers. For engines the horsepower is determined on the basis of 40 lb. mean effective pressure for simple engines noncondensing, 50 lb. mean effective pressure simple condensing, and 70 lb. for compound engines reckoned on the high-pressure piston.

Any plant found in operation without a licensed engineer shall be given 5 days from the notification to the plant and after that such operation shall be a violation of the law. Penalty shall be not more than $300 or imprisonment for not more than 6 months. Suit shall be brought by the chief examiner. Licensed engineers must display their licenses under glass in the engine room, under penalty of $5 for not doing so. If a license is lost, it shall be renewed without payment of fee or examination on proof of such loss.

Any engineer who has been operating a plant for 3 years at the time of the passage of the act shall be given a license for that plant without examination. The act is to take effect on June 1, 1911, if it passes in the form as adopted.

Arguing as to the desirability of changing "stationary" to "operating" in the name of the association, it was voted to do this.

A vote of thanks was given to Representative Kellar and to Messrs. Feeley and Lee, who had worked hard for the license law during the past year. Number 36, of Jamestown, was advised to reconsider its letter of withdrawal and the matter was referred back to the association for consideration. The importance of urging assembly men and senators to act favorably on the license law at the next session was urged and resolutions of thanks passed to the Buffalo local committee for its excellent work.

Officers chosen for the coming year were: President, Charles Schabacker, of Brooklyn; vice president, Winfield Graham, of Buffalo; secretary, E. E. Pruyn, of Rochester; treasurer, Geo. O. Kaley, of Brooklyn; conductor, William Downes, of Brooklyn; doorkeeper, Frank J. Leopard, of Jamestown; chaplain, Stewart Warner, of Syracuse; state deputy, James R. Coe, of New York.

For the convention of 1911, Albany was chosen as the place of meeting. Adjournment was then taken and the delegates separated to meet again at 9 p. m. in the Dutch Room at Staatler's, where the convention closed with a banquet presided over by Herbert E. Stone, of the Dearborn Drug & Chemical Works and at which the vocal entertainment was furnished by Joseph McKenna and Billy Murray, of Jenkins Bros., Frank J. Corbett, of Manning, Maxwell & Moore, and Jack Armour, of the Hill Publishing Co.

ENGINEERS AUXILIARIES

LOBSTER was the center of attraction, but not the chief thing which the Albany Lubricating Co. had to offer visitors. A. D. Page, the New York State representative, had arranged for the "bug" a corral made of an attractive display of Albany Grease cans comprising the 7 different densities for all classes of work.

ANDERSON traps catch water, and the sectional model shown by L. H. Rumage, New York State manager, demonstrated just how this is accomplished and the reason why the Anderson trap is able to do its work thoroughly.

McCARTHY BROS. & FORD, representing the Sprague Electric Co., exhibited electrical specialties, electric fans, etc., and E. O. Day and J. A. Munhall in charge of the exhibit supplied visitors with literature on the Sprague motors.

THOSE FROGS which the Dearborn Drug & Chemical Works introduced illustrated the live methods of the company and were good running mates for Herbert E. Stone and Dan Gregory, the lively representatives. The mottoes used for decoration were especially striking, such as "Remember you are hired to do your best," "A merry heart doeth good like a medicine."

F. J. O'LEARY, mechanical engineer for the Penberthy Injector Co., and Mr. Robertson, representative of the Penberthy Engineer & Fireman, had to offer for the instruction of engineers sectional models of injectors large and small, and fine wash drawings showing details of construction. Oil cups, ejectors and gage fittings were also included in the interesting exhibit.

GREENE, TWEED & CO.'S packings were favorites, as well as the Favorite Reversible Ratchet Wrench, which B. M. Bulkley, representative of the company, explained. Packings included the Palmetto Twist and other varieties for steam work, Manhattan Hydraulic packings, Palmetto gasket tubing, etc.

SPECIAL subscription offers were the feature at the space of Practical Engineer.

LITERATURE on the Jones Underfeed Stoker was tastefully arranged by Wm. T. Johnson, representative of the Under-Feed Stoker Co. of America for the Buffalo district. The catalogs showed a list of Jones stoker plants in the vicinity and included a pocket catalog of the Jones Underfeed.

STRONG steam specialties, made by the Strong, Carlisle & Hammond Co., Dixon graphite and belting made by the Jos. Dixon Crucible Co., Cross oil filters made by the Burt Mfg. Co., Stephenson Bar Belt Dressing made by the Stephenson Mfg. Co., were found in the exhibit of the Buffalo Mill Supply Co.

BELMONT special packings for every possible condition, including stitched hydraulic and the No. 19 sheet for superheated steam, were included in the exhibit of the Clement Restein Co., whose representative was Alton E. Fennel.

OILS for all purposes and suitable for all kinds of bearings were shown by the N. B. Fails Lubricating Co., of Buffalo.

LIBERTY goods displayed by Karl Sixt, of Buffalo, in the space of the Liberty Mfg. Co., included a section of the Faber blowoff valve, the Liberty feedwater regulator, the Liberty pump governor, the Liberty Twin strainer, the Liberty tube cleaner and the Norivet head.

SKINNER engines were most completely demonstrated by the plant in the engine room of the Iroquois Hotel, but as an adjunct there were shown in the exhibit hall photographs of various plants and of the details of Skinner engines, including the oil pump for automatic lubrication, the sight-feed manifold for showing just how much oil is going to each bearing, the oil filter for the lubricating system and other special devices particularly designed and manufactured for this engine. A. D. Skinner, of the Skinner Engine Co., was in charge of the exhibit.

TALL flasks of lubricating oil constituted an attractive display arranged by the C. M. Stebbins Oil Co., representing the Pease Oil Co. A striking feature was the samples of cores for castings made by the use of the Upson core oil.

SAMPLES of Garlock Packings and literature explaining the qualities of the different styles were shown by A. C. Traut, of the Buffalo office.

LUNKENHEIMER goods made their usual attractive appearance and there were included in the exhibit quick-closing valves, oil and air cocks, oil cups, force feed oil pumps, blowoff valves, blue prints of the Renewo valve and the Lunkenheimer self-grinding gage cock. The company was represented by A. S. Phillips, of Cincinnati.

RED STAR boiler compounds and compound feeders, also the new product Ideal pump valves, were displayed by the Lake Erie Boiler Compound Co., its representatives being E. C. Schwingel, pres.; J. R. Pratt, sec., and G. J. Juhre.

THE ROBERTSON Cataract Co. showed a line of General Electric Co.'s supplies for wiring circuits, cables, switchboard cabinets and other electrical apparatus.

RAINBOW Sheet Packing was the prominent feature of the display of the Iroquois Rubber Co., representing the Peerless Rubber Co. There were also Peerless, Success, Eclipse, and Honest John packings in various styles for all purposes. Representatives were Edward F. Smith, J. M. Voltz, J. S. Waterson.

BOILERS, castings and grate bars, the product of the Farrar & Trefts Co., were described in catalogs.

KEYSTONE Grease arranged in cans, pyramids and crescent form were displayed by F. E. Putney, of the Boston office of the Keystone Lubricating Co.

THE MOTION BOARDS of J. H. Williams & Co. attracted much attention, the action of the arm Vulcan Bijaw wrench being extremely lifelike, and that of the ratchetless ratchet wrench being convincing as to the value of the device.

JENKINS BROS.' globe and gate valves, the Jenkins traps, Jenkins tabular gaskets, Jenkins disks for pumps, and the '96 sheet packing constituted the display of Jenkins Bros.

GEO. M. OTIS, of the Stewart Heater Co., arranged an instructive nickel-plated model of the Stewart heater, showing the construction of the heater tubes, the chamber for collecting and carrying off impurities, and samples of water before and after purification.

CONVINCING evidence of the effect of Cling-Surface on belts was shown in samples of those which had been treated and those which had not. Belts which had been in service many years and were still in good condition contrasted strongly with those which had been running but a short time without treatment of Cling-Surface and yet were stiff and ready to break on the slightest provocation. Dr. W. B. Young and T. H. Clark represented the company.

MANNING, Maxwell & Moore was represented by H. B. Aller and Frank J. Corbett, and catalogs of the various constituent companies showed the Consolidated safety valves, Ashcroft steam specialties, such as gages and Tabor indicators, Metropolitan injectors and Hancock inspirators.

QUALITY oils, as made by the Buffalo Refining Co., were shown by C. B. Matthews, manager.

McLEOD & HENRY CO., by means of a front door arch built partly of ordinary firebrick and partly of Steel Mixture, showed strikingly the difference in qualities of the two. Steel Mixture, as its name implies, is metallic in texture and with a clear, strong ring, while the firebrick was of the nature of a stone. N. C. Morgan and John H. Foote were the company's representatives at the convention.

FOR the Home Rubber Co. A. R. Foley was on hand as usual, with a full supply of flies which do not carry germs and with samples of the N. B. O. sheet packing and the O. I. M. low-pressure packing. The Vesuvius pamphlets were a particularly attractive piece of advertising literature. Chas. H. Swoger also represented this company.

THE International Steam Pump Co. was represented by Jos. K. Haigh, of Buffalo.

WM. POWELL CO. was represented by Mr. Leonard.

J. J. LEIGHTON, of Buffalo, represented the Erie Foundry Co.

SURFACES OF FACTORY FLOORS

INVESTIGATION of surfaces for factory floors by the Aberthaw Construction Co., of Boston, and experiment on the satisfactory wearing qualities has shown that 2 types are available. For what is called the granolithic finish the base, if of old concrete, should be roughened so that the mortar will adhere to it, the top then thoroughly wet and kept wet long enough to absorb all the water it will take up. The top is then put on, consisting of a mixture one part Portland cement, one part stone from 1 to 2 in., excluding dust, and one part sharp sand, the majority of sizes passing between a 20 and 30 screen. This is mixed to a stiff paste, wet enough so that in trowelling water will work to the surface.

In applying, the surface of the old concrete is first scrubbed well with a thin grout of pure cement, rubbed in with a broom. On top of this a thin coat of the finish is trowelled hard to give a firm bond, and after this the further coat of finish is applied of desired thickness and floated to a true surface. If the finishing is done in hot weather, protection from wind and sun should be given to prevent too rapid drying.

For a wood top floor to be locked to concrete, F. W. Dean specifies 2 by 3 in. beveled edge plain sleepers built into the concrete, the concrete being brought up to within 2 in. of the final thickness, sleepers then accurately placed parallel 18 in. apart and at right angles to the girders. Concrete is then poured between the sleepers and the surface leveled with the tops. On top of these sleepers at right angles to them are spiked square edge plank surfaces on one side and both edges 3 in. thick and 7 to 10 in. wide. This plank is tightly drawn up and nailed with 2 4-in. nails at each bearing, the ends of the planks meeting half way between sleepers. The finished floor is of clear stock maple ⅞-in. thick, planed even and with edges and ends squared, laid in the ordinary manner for finished flooring.

AMERICAN ORDER OF STEAM ENGINEERS

24TH ANNUAL CONVENTION. PHILADELPHIA, JUNE 6 TO 10.

MEETINGS of the association were held in the Odd Fellows' Temple, Broad and Sherry Sts., the meetings beginning Monday morning and continuing each morning and afternoon with the exception of Tuesday afternoon, which was devoted to a ball game, and Wednesday afternoon, which was occupied with a trip up the river.

Meetings were well attended by delegates and members of the order and the officers elected for the coming year were: Supreme chief engineer, Fredrick Markoe, Abington, Philadelphia; first assistant, L. G. Schlekner, Philadelphia; recording engineer, F. J. Armbruster, Philadelphia; corresponding engineer, W. S. Wetzler, Philadelphia; treasurer, T. J. Donovan, Philadelphia; master mechanic, W. J. Courtney, Columbia; junior master mechanic, Michael Helmstreit, Philadelphia; trustee, D. B. Heilman, Reading; inside sentinel, Geo. Goodwin, Baltimore; outside sentinel, Wm. Baers, Allentown; chaplain, James Lightfoot, Philadelphia.

It was decided to return to Philadelphia next year for the convention.

Entertainment features consisted of visits to the exhibit, which was a fine one and well worth a careful examination, a ball game between the engineers and exhibitors Tuesday afternoon, at which the engineers won; a steamer trip on Wednesday, during which the city fire boats gave an exhibition fire drill, and an entertainment with singing and specialties on Thursday evening, followed by a reception to the supreme officers.

During this evening Chas. A. Hopper, retiring president of the Supply Men's Asociation, and Harry E. Souders, manager of exhibits, each was presented with a handsome leather hand bag in appreciation of their work during the convention.

On Wednesday evening a lecture was given on "Electrical Apparatus and Its Operation."

The ladies were entertained on Thursday afternoon by a sight-seeing automobile tour about the parks and notable historic locations of the city.

On Thursday afternoon the meeting of the Supply Men's Association was held and the report of the nominating commitee presented and adopted. This gave the following officers for the coming year: President, Richard Foley, Home Rubber Co.; vice-president, Harry Crowder, Crandell Packing Co.; secretary, Fred L. Jahn, Watson & McDaniel Co.; treasurer, John W. Armour, Hill Publishing Co.; executive committee, Frank Martin, Jenkins Bros.; Harry Souder, John R. Livezey; Chas. P. Sanville, McArdle & Cooney; E. J. Rooksby, H. B. Underwood & Co.; H. Rittenhouse, Quaker City Rubber Co.; Albert Schade, A. Schade Co.; Harry H. Krauth, Peerless Rubber Co.; T. B. Stein, H. W. Johns-Manville Co.; Capt. J. E. Doughty, Geo. W. Lord Co.; Harry Winner, Garlock Packing Co.; Chas. E. Hopper, Keystone Lubricating Co.

DELEGATES AT THE CONVENTION OF THE AMERICAN ORDER OF STEAM ENGINEERS

SEEING THE PHILADELPHIA SHOW

BRICK, just fire brick in all sorts of shapes, in all sizes and for all purposes. And good fire brick, too, for making walls settings, furnaces, back arches, front door arches, chimney linings; whatever you need. Carl A. Dickel of Cyrus Borgner Co. had them; all there.

DO YOU WRITE? Then Joseph Dixon Crucible Co. had pencils for you. Also other products made from Ticonderoga flake graphite. Graphoil, dry graphite, stick graphite, grease and graphite, belt dresing in fluid and stick form. And to show you were J. Maurice Willitts and Howard H. Wood.

DICHTINGSGUMMI sounds like a German swear word; but it's the sheet packing made by Strong Machinery and Supply Co. Other brands shown by L. E. Strong, S. R. Brome and G. Ekstrom were Rivalate metallic, Strong ring and spiral, and superheat, and I. O. P. valves. The right

number of beans in the bottle meant a nice clock for the fortunate engineer who guessed right.

AND IT BLOWS; that's the Diamond Flue Blower shown in full sizes and arranged as attached to the boiler by W. H. Davis of the Diamond Power Specialty Co.

BOARDS AND BOXES; i. e., panel boards and boxes, also switchboards with instruments, switches and full equipment were arranged by the Pringle Electrical Co.

WHAT PRESSURE? The American Steam Gauge and Valve Co. can show you with gages or with the American Thompson Improved Indicator; and the Inspector's gage tester will prove the records accurate. Whistles, brass specialties, a sectioned pop safety valve, reducing wheels; all were there for inspection.

ANOTHER PHILADELPHIA SHOW. It stays the year round in The Bourse, Machinery Exhibition and Salesroom, and L. R. Duffield and Gilbert Keller proved by views of the exhibits that it is a success.

YES IT DOES. Cleans boiler tubes; the Roto Co.'s Boiler tube cleaner, and the working motor for water or air was run to show how; heads for all kinds of scale, too. J. F. Swan of the Philadelphia office proved it.

AROUND THE POST; then back again. It's all the same to flexible metallic tubing. Schoen-Jackson Co. showed it in sizes from gas portable ⅛-in. up to 3-in. W. H. Wood proved the value of the interlocking joint for air and steam hose.

PRACTICAL, always, the Practical Engineer and S. W. Anness and Arthur L. Rice gave practical help to visitors wherever possible.

CHEMICAL SPECIALTIES, especially in boiler compounds and lubricating oils; that's the W. B. McVicker Co., and G. Frank Duemler was specialist for the convention.

IT PAYS TO WASH the air you breathe; so the Warren Webster Co. showed how to do it. Not only washed clean, but cooled or heated to any desired temperature and with the right amount of moisture in it. The display of a Star exhaust feed heater with attached separators, valves and heating specialties was perfectly planned for the purpose and the space. E. K. Webster, John Montgomery, and E. K. Lanning were demonstrating the specialties, and Wm. G. R. Braemer the air washing system.

IT WORKS SO EASY. That arm and Vulcan Bijaw wrench of J. H. Williams & Co. was visible proof of the fine action of the tool. And the Ratchetless Ratchet Wrench is one of those clever devices that you want the minute you see it. A. L. Whittemore explained why the Bijaw gives 2 in 1.

T. J. WILLIAMS of the Ford and Kendig Co. represented the Lunkenheimer Co. and its specialties.

LAGONDA AND WEINLAND; one stands for automatic cutoff valves, and reseating machines, the other for tube cleaners, motors and cleaner heads. All are the product of the Lagonda Mfg. Co. And the representatives, Hart Hill, Chas. F. Overly and M. O. Lewis showed their enterprise as well as the Enterprise Strainer.

BUNDY TILTING TRAPS, also Bundy separators and other specialties of the Bundy Department of the American Radiator Co. were the theme of A. S. Mappett, A. L. Lissen and S. H. Opdype.

BELFIELD BRASS GOODS, including renewable disc valves, globe and check styles, injectors, pump and pressure regulating valves, formed the exhibit of H. Belfield & Co.

BLACK SQUADRON, all in black, in all styles and shapes, for all sorts of uses. Yes, packings made by the Cancos Mfg. Co.; also Cancos metal polish, and stranded valve spool packing. There was a gold watch for the engineer who got the right number, with S. M. Costello and Harry Harmstadt registering the names.

LINE O LITE, that's what kept the booth of the H. W. Johns-Manville Co. so well lighted. They had Kearsarge jointless gaskets, copper backed gaskets, Permanite gaskets, Vitribestos, magnesia and other forms of pipe covering, Mobilene packing for autos, the Success fire extinguisher; who were "they?" T. B. Stein, E. N. Drew, Wm. Miller, W. G. Bonner and B. C. McClure. They also had 2 new specialties, Cork sheet for cold storage insulation and the Non-burn lining for brake bands or elevator machines and cranes.

PHOENIX IRON WORKS boilers and engines were their own endorsement.

UTILITY SPECIALTIES include separators, feed-water heaters, pump governors and exhaust heads. Both lines were displayed in the double space exhibit of Jas. F. Marshall Co., also the Dexter Engineering Co., with J. F. Marshall and G. C. Frantz as representative.

GREASE THE GUIDES. That's the motto of the Imperial Elevator Guide Lubricator made by the American Engineering and Mfg. Co., which was displayed by J. F. MacIndoe and G. B. Smith. They showed also the Stewart feedwater heater. There was a new style Imperial without tubes and another with reversible side shoes to clean out easily. All passers were "pinked" every day.

FRANCE IS NOT A COUNTRY; it is a metallic split ring packing made by the France Packing Co. Also it is square, round and braided packing as required for any use. And Endurol is a new sheet fibre packing by the same company. A. W. France and J. F. Borland represented the company. Its latest is a new well point for air lift pumps which increases the efficiency largely.

MASON STAR COAL, by the Mason Coal Co., was the exhibition of J. W. Mason.

IT WAS A BIRD-ARCHER of a calendar that T. H. Desmond gave to visitors to the Bird-Archer Co.'s booth to keep them in mind of its compounds and the work they do.

GREASE AND CUPS, made by the Philadelphia Grease Mfg. Co., were shown by H. A. Smith and T. A. Collins.

YES, THEY'RE STRONG, also they're Strong traps for pressure and vacuum and separators with copper perforated lining. Strong, Carlisle & Hammond Co. make these and other specialties which C. H. Camp and Homer Whelpley and A. B. Penny demonstrated.

YORK REFRIGERATING MACHINERY and fittings for ammonia plants, also prints of plant construction and arrangement, bands, condensers and special apparatus, all made by the York Mfg. Co., were exhibited by W. D. Gillespie, J. M. Gillespie and W. D. Coulter of the Central Construction and Supply Co.

ENGINEERING EQUIPMENT CO.'S exhibit of circuit breakers and oil break switches was in charge of Joseph P. Manypenny.

ALL KINDS OF BRASS goods, including Ashcroft gages of all descriptions, Tabor indicators, Hancock inspirators, Metropolitan injectors, Consolidated safety valves were found in the exhibit of Manning, Maxwell & Moore, Inc., in charge of Frank J. Corbett, L. B. Brigham and W. P. Bradbury.

P. P. P. IS A ROD packing and Ebonite is a sheet. Valvolite is a twist for stems; Holetile is a spiral for rods; Skihi is red sheet and Ironsides is a belt; but all are made by the Quaker City Rubber Co.—the big red D is its symbol —and W. D. Purcell and Henry Rittenhouse looked after them all.

THIRTY-SEVEN POUNDS OF SCALE in one chunk was the extraordinary sight at the exhibit of Thos. C. Warley & Co. It stood as it came from the boiler and looked like a coral reef. Other "horrible examples" and samples of the dry powder compound as prepared for different waters were also shown by the representatives, Thos. S. Warley, Geo. C. Davis, H. Bentley Smith and Geo. T. Thompson.

COPPER AND ASBESTOS make a good combination for a gasket. They are neatly combined in the National Safety Gasket made by the Dyna-Como Co. into gaskets of all shapes and sizes, shown by Wm. I. Maude and C. L. Osborne.

FOLEY FLIES everywhere, and he will be flier than ever now that he's president. But he, with Elmer Bainbridge and Wm. Berger, still represent the Home Rubber Co., and were exhibiting N. B. O. sheet packing, square packing and round gasket.

McDANIEL TRAPS and Watson pump governors and reducing valves, with other specialties made by the Watson & McDaniel Co., were in the booth of that company in charge of Fred L. Jahn.

ALL THE PACKINGS made by the Peerless Rubber Co. were there, at any rate a long line, and among them Rainbow sheet, Success Diagonal Expansion spiral, with Rainbow core —a semimetallic which can be coiled to any size and will stay there, Honest John spiral, Eclipse gasket, etc. The exhibit was made by the Goodall Rubber Co., Inc., distributors, with L. Hillman and H. Krauth in charge.

VALUABLE HELPS in steam engineering were to be seen in the space occupied by McArdle & Cooney. Among these were Wright Emergency traps and safety water columns, Williams valves, oil cups and other brass goods, the Skinner valve reseating machine, Oster threading tools, Ajax valves with elastic metal disk. Bard unions with removable seat, the Vulcan Bijaw wrench, Austin separators for steam and oil, the Wright Cyclone exhaust head; and to help visitors understand these were Chas. P. Sanville, Jas. White and W. E. Holmes.

UNDERFEED STOKERS stroke underneath and that's why there are underfeed. In its space the Underfeed Stoker

Co. of America, through its representatives, S. Crowell and Walter S. Crowell, made this and other good features clear, also the advantages of the Northern Water Softener.

THE FAVORITE feature of the exhibit of Greene, Tweed & Co. was the Favorite reversible ratchet wrench; it turns either way without removing from the nut, and through any distance. B. M. Bulkley explained its action, also the features of Palmetto packings in round, squared and twist for steam service and the Manhattan brand for hydraulic machinery.

GRANT SPEAR was the main exhibit of the Dearborn Drug and Chemical Works, but H. G. McConnaughy helped a lot. Dearborn's work is too well known to need comment.

CORTAY? That's packings and pump valves over there where F. E. Thomas and E. A. Corbett are telling stories, true ones, about what these goods are doing and will do.

VACUUM OILS, lubricating and cylinder; why "vacuum"? We don't know. Ask the Vacuum Oil Co.

sign. Carlisle Mason, W. J. Spencer and R. E. Thomas cared for visiting friends.

IT IS EVERLASTING, that's where it gets it's name; the blow-off valve made by the Scully Steel and Iron Co. and demonstrated by John H. Allen.

BRUSH UP on lubrication with the Keystone Lubricating Co. Chas. A. Hopper, A. C. Buzby, H. A. Buzby and W. F. Buzby will all help and Keystone grease will do the lubricating. The samples were to prove it. The public stenographer was a great convenience to all.

DYNAMIC and Automatic and it feeds the grease to the last drop uniformly. That's the claim for the cup made by Chas. H. Casper; Jas. J. Allen and H. R. Lockbaum showed how the cup does it.

ZURN OILS were shown by the O. F. Zurn Co.

MAZDA LIGHTS also tantalum, tungsten, imperial and army and navy lamps made by the Bryan-Marsh Co. were

SUPPLY MEN AT THE PHILADELPHIA CONVENTION

DIBBLE and Van Kleek and the only Jack Armour were there badgering everybody as usual for Power.

'96 NO NOT '76; '96 sheet packing with the diamond stamp packing and Jenkins globe and angle valves with the same stamp and Jenkins disks and the straightway blow-off. Jenkins Bros. diamond trade mark is on them all. Frank Martin, no convention complete without him, or Jos. McKenna and Billy Murray to help out the "bunch" and there were also Jas. McHugh, Samuel Laird, John Smeltz and Arthur Kreibel.

TRANSMISSION APPARATUS and station supplies were the stronghold of the Fairbanks Co. Pipe fittings, unions, brass goods, Oneida pulleys, Penberthy injectors, the Parmelee wrench, the Burt exhaust head, the Cross oil filter and Dick's balata belting were some of the specialties. M. V. Cordell and Samuel McCullum were the specialists.

TAURIL is one of the group of Anchor packings; it's a fiber sheet. There are other kinds, a metal wedge packing for plungers, a square metallic, braided of german silver wire, and more still. But the Anchor Packing Co. makes them all and C. M. Barnes, W. E. Swiler and D. J. P. Murray were selling them.

EXTRA HEAVY, all steel castings for superheated steam of 400 lb. pressure and 350 deg. superheat, total 800 deg. That is the description of the big Nelson valve in the Nelson Valve Co.'s booth. There were other valves, gates with the special Nelson expansion wedge and globe of special de-

found in the space of the Wilkirk Electric Co. with J. H. Michels in charge.

ALWAYS TURNS UP right, does the crank pin turning device of the H. B. Underwood Co. And the cylinder reboring machine is just as true. That's their business. E. J. Rooksby and E. C. Crawford who know all about it told us so and showed proof of the quality of products in one set of St. John's steam piston packing that had run 14 yrs. on a tugboat and was still ready for service and another set that had run for 10 yrs. on stationary work. The noiseless safety ammonia compressor valve and packingless dash-pot for Corliss engines are also good devices.

COCHRANE SPELLS SERVICE in feed water heaters and the new steam stack and cut-out valve on heater and receiver spells double service as explained by J. R. Hibbs at the exhibit of the Harrison Safety Boiler Works. Cochrane separators, horizontal and vertical for steam or oil were also shown.

A BERRY IS not a fruit, when it comes from the Berry Engineering Co. works. It's a damper regulator or a feed-water regulator and pump governor, or a quick pull gage glass fitting, or a feed-water heater or may be a boiler. Anyway it's grade 1 in first-class condition, and J. J. Buckley can prove it.

STEEL IS STEEL and Steel Mixture is like unto it in hardness and durability; but it's made up in convenient brick shapes just right to fit the furnace or front door arch or back arch where it is to be used. The boiler setting model showed

how it comes in, and John H. Foote and F. V. Tuthill explained the rest.

MARCK that expansion trap and the Vim of the leather and those oilers which E. F. Houghton Co. showed along with the Houghton filter as part of "The Houghton Line." Then you appreciate why Franklin R. Moore was enthusiastic in talking Houghton.

WHEN YOU SEE CALIPERS think of Garlock. That's the reason the Garlock Packing Co. use the trade mark. They put it on the No. 900 white fibre packing and on the boxes of all the rest of the Garlock line of fibrous, rubber and metallic packings that carry the Garlock name. A. J. Schmidt, R. O. Blenis, Hugh Edwards, Chas. Blennon and Richard Peck were the 5 of a kind at the booth.

J. W. SMITH and S. B. Koons represented Southern Engineer.

IF IT'S CORK, John R. Livezey has it and H. E. Souder, M. A. Neely or H. A. Hutt would show it to you. It might be corkboard insulation for refrigeration and cold storage insulation, or cork pipe covering for brine systems or ground cork for packing, anyway it was there.

DAVIS VALVES, the special kinds made by the G. M. Davis Co. and Sterling force feed lubricators; those were some of the good points brought out in the exhibit of the Albert Schade Co. by Albert Schade, L. M. Lewis and O. B. Lewis.

THEY WERE RESPONSIBLE for the contest, for they gave the handsome silver cup which is to go as a prize to the winner in a series of base ball games between teams from the A. O. S. E. and the American Supply Men's Association. Engineers drew first blood. They? The Frick Grate Bar Co., of course, making, naturally the Frick grate bar, and represented by C. V. Frick and H. E. Frick.

SYNONYMS; words that mean the same; Ashton,—and high grade brass goods; safety valves, relief valves, gage testers, and other Ashton products; G. L. Buckman was the man to be asked.

ANY BAD JOINTS? Take Crandall! The Crandall Packing Co. is the doctor and H. A. Crowder was the operator. Lip packing for hydraulic work especially recommended; also other styles for all kinds of steam and water service. The sample case showed them.

WILSON VAN BUREN represented the Engineers List.

AIR TIGHT, steam tight, water tight; made of metal yet flexible as rubber and of strength to stand any pressure. That sounds large, but it's the locked joint that does it, and the Pennsylvania Flexible Metallic Tubing Co. knows how. It made a beautiful exhibit as well as instructive and J. M. Odenheimer had a right to be proud of it.

FOR THE CONVENIENCE of visitors, Philadelphia Council No. 1 had a headquarters booth for the local committee on entertainment with Wm. Pavient, secretary, in charge. The courtesy was greatly appreciated.

OILS, both cylinder and lubricating are the product of the Valvoline Oil Co.

MECHANICAL REFRIGERTION was the topic with the Mechanical Refrigeration Co. representing the Vilter Mfg. Co. The display was an ammonia compressor, ammonia fittings, valves, gages, pipe shapes, anything for an ammonia system.

LORD'S BOILER COMPOUNDS. The Geo. W. Lord Co. makes them and they make good. Geo. W. Lord, Capt. C. E. Doughty and Chas. Philips, also made good at the booth.

IT WAS A TRIUMPH that the Trill Indicator Co. designed to take 200 ft. of indicator cards on a single continuous strip. That's some diagram. There were other novel features that you heard about too from W. T. Trill and Leonard McElroy concerning the Triumph reducing wheel and indicator and the Trill planimeter.

ENGINEERS LIKE to study details and the Parker Boiler Co. appreciated the fact and showed how the Parker Boiler details are made by models, full sized parts, prints and photographs. H. O. Moore, J. W. Thomas and Edward T. Binns entertained at the booth.

AT THE MEETING of the Technical Publicity Association, of New York, for May, the matter of house organs was discussed by the different members, those who were in favor of them arguing strongly for them and those who were opposed being just as strong in their convictions. The conclusion from the discussion is about that which one gets from any such a discussion, that a thing well done usually succeeds and a thing poorly done is usually not worth while.

GAS ENGINEERS IN CINCINNATI

SINTON HOTEL, JUNE 13 TO 16

IN A short year and a half the National Gas & Gasoline Engine Trades Association has risen from a thought in the minds of a few enthusiastic men to a reality which is sure to be of the greatest help to the industry throughout the country.

The quality of the papers at the convention was high and the subjects covered a range over the entire field of the gas and gasoline engine industry. To the efforts of M. A. Loeb, president of the association at the present time, can be credited much of the success which the association has now attained and which it promises to attain in the future.

In opening the meeting President Loeb welcomed the association to Cincinnati and expressed hope of great benefit to come from the papers and discussions. He introduced John Galvin, the vice-mayor, who characterized Cincinnati as the best city and having the best people on the face of the globe. He told of the fact that Cincinnati is the only city in the world which has built a railroad 300 miles long, extending from Cincinnati to Chattanooga, and bonded itself for $20,000,000 to do so. The income from the leasing of the railroad property is now sufficient to retire the bonds and in a few years will be sufficient to pay the entire expenses of the city.

C. O. Hamilton, replying to the address of welcome, told of the origin of the association, of the work of Messrs. Loeb and Stritmatter in bringing it to its present flourishing condition, and the object of the association, which is to acquaint those engaged in gas and gasoline engine manufacture, sale and operation with each other so that they may co-operate in advancing the interests of the industry. The treasurer reported a satisfactory balance on hand and resolutions committee was appointed.

Dr. E. G. Acheson, of the International Acheson Graphite Co., Niagara Falls, N. Y., gave then an interesting demonstration of the properties of the artificial graphite which his company manufactures and its effect on the problem of lubrication. This address will be published at length in a later issue.

Comparing the gas tractor and the horse, L. W. Ellis outlined the development of the horse from its earliest beginnings and the process of selection that has resulted in the present day farm horse, which is the chief power plant of the farm at the present time, and showed that the gasoline engine can do work more economically than the horse and has greater efficiency considered as a machine for turning heat of fuel into mechanical energy. The thermal efficiency of the horse, considering his idle time and food consumed, is from 1½ to 2 per cent for a year and he will be able to give on the average ½ hp. as engines are rated. The space required for the sheltering of a 25-hp. tractor is approximately 0.1 that required to shelter 25 horses and their food supply for a year. Mr. Ellis showed that in arranging for engines for farm work it is no more fair to try to make one engine do all the work than it is to make a single horse serve equally well for heavy draft and for light driving. He prophesied, therefore, in the early future 2 types of farm tractors, a massive engine for heavy work and a light motor for cultivating and similar tasks.

Advertising and Publicity

AT the afternoon session the matter of advertising was taken up and a paper by W. R. Emery, of Everybody's Magazine, outlined his belief as to the cardinal principles of advertising. "Heavy Hitting in

the Advertisers' League," by Ren Mulford, Jr., called attention to the fact that in advertising, as in baseball, a single hit does not win the championship. What is needed is consecutive hitting and attention to the game. He emphasized also the need of putting good copy into good space, the importance of human interest in the story told in the advertisement, and advised the employment of advertising experts to prepare advertising copy. He summarized the points, as "the secret of abiding business conquest through advertising is keeping everlastingly at it; before you begin, be sure of your proposition; and don't overlook the fact that it takes more than a few scattering hits to win the game."

Osborne Monnett, treating of the manufacturers' relations with the technical journal, brought out the tendency of many manufacturers to withhold technical details in regard to their engines for fear some one else might get an idea from the description, the result being that the descriptions as given out are monotonous and have little of real interest. He asked for the co-operation of manufacturers in giving such information in regard to their product as engineers want, line drawings showing the real construction of parts and data showing dimensions, capacities and performance.

The evening of the 14th was devoted to a steamboat ride to Coney Island Club House and a dinner, at which Mr. Mulford officiated as toastmaster. Bright addresses were made by Ira Stark in response to the ladies, by C. O. Hamilton on the "Co-operation of the Press," by Mr. Bigelow on the "Duty of Manufacturers Towards the Press," by H. W. Jones on "Why He Should Be the Next President," by W. R. C. Smith and by M. A. Loeb on "The Next Convention."

Producer Gas

WEDNESDAY morning the first paper taken up was "The Oportunity for the Gas Engine in Mexico," by G. W. Hall, who said in part:

"We must look to the suction gas producer as the principal source of power in Mexico, and in order to have it become universally used in a country where the majority of people who consume power are inexperienced, the producer and gas engine must be of a simple and durable construction, as well as supply clean and pure gas, free from tar, that the consumer may be assured that his plant will operate with the continuity and assurity of a steam engine.

"In order to produce this kind of gas we must not depend entirely upon the scrubber. We must produce the gas almost clean and free from tar, or we shall find a great percentage of tar in the cylinder and valves and encounter the delays and troubles consequent thereto.

"I have made some tests with a down draft producer, taking out the gas through the hottest part of the fire in order to obviate tar in the engine. By this process I produce gas free from tar, converting this rich fuel into gas instead of taking it into the engine, and also avoid the excessive use of oil in an endeavor to dissolve it. Therefore in order to have the gas engine reach the highest state of efficiency we must supply it with clean gas.

"My sad experience in Mexico with many engines using producer gas has been that they would run but a few days, be shut down and cylinder heads taken off and valves removed and cleaned. The class of producer gas in Mexico should be such as will obviate these difficulties and as soon as this point has been reached we will be unable to supply the Mexican demand alone for this class of power.

"My advice is not to send tar producers to Mexico, as only first-class machinery will be purchased there. Mexico can pride herself on having some of the finest plants in North America, and we must not lose sight of the fact that only the best is wanted in the land of the Aztecs."

Mr. Hall is a machinery manufacturer in San Luis Potosi and much interest was manifested in his statements and many questions asked him in regard to the condition of gas engine and other industries in Mexico. The information that he gave placed the industrial condition of that country in a new light with many of those at the convention.

An interesting demonstration of the action of different kinds of electric sparks was given by Carl Pfanstiehl with high voltage apparatus. The subject was "Ignition," and after showing clearly the action of the different kinds of apparatus and how various difficulties are overcome, he proceeded with the demonstration, which was not only instructive but a beautiful exhibition of the power of the electric spark. An abstract of his paper as presented will be given at a later time.

W. R. C. Smith discussed the progress which the South has made in the last few years, the number of mills now in course of construction, the increase in the output of iron, coal, cotton and sugar, and the opportunities which are arising there for the installation of gas and gasoline power plants in the cotton gins, oil mills, sawmills and other isolated plants.

L. F. Burger's paper on "Producer Gas Power" told of the development of this source of fuel supply for a combustion engine by reason of the work of Dowson, who introduced steam as a means of forcing air through the heated coal mass, the work of Mond, who adapted this system for soft coal, that of Wiegand, who introduced the principle of the suction gas producer, of Benier, who first put this principle into successful practice, and finally the development in American practice, which is a different problem from that abroad because of the different qualities of the American coal.

He stated that producing a successful apparatus is not easy. The manufacture is simple, but the design is difficult. He outlined the process of the formation of producer gas and stated that a number of installations showed a kilowatt-hour produced at the switchboard for 1 cent, with anthracite coal at $5 a ton, this cost including interest on investment, depreciation, coal, engineer's wages, oil and waste and taxes and insurance.

Mr. Burger had even gone so far in his researches on the question of cost as to fire a steam boiler with producer gas and produce power at the same time, with the result that the boiler could be fired at less cost with gas than with coke, the coke costing $5 a ton and the anthracite coal $6.35 a ton.

Entertainment was furnished on Wednesday evening by a visit to the Zoological Gardens and a concert by Weber's Band, features which were appreciated by those fortunate enough to be of the party.

Gas Engine Wastes

THURSDAY morning's meeting was the closing session of the convention, and the first paper, by Prof. John T. Faig, on the "Utilization of Heat from Gas Engine Plants," pointed out the heat lost in various ways in the gas engine and showed by a number of tests (Fig. 1) that the heat lost in jacket water, exhaust and radiation runs from 57 to 79 per cent, while the heat converted into useful work at the flywheel may be averaged at 21 per cent. He proposed to save

by the use of interchangers a large part of the heat wasted in the exhaust and the jacket water, heating by means of these interchangers water which can be used either for industrial purposes or in heating buildings. Fig. 2 shows the methods by which heat is lost and Fig. 3 the arrangement proposed for catching some of the waste heat and converting it to useful purpose. The counter-current type of interchanger is found most satisfactory and tests have shown that 60 per cent of the heat otherwise wasted in jacket and exhaust can by this method be utilized.

J. D. Lyon, of the Westinghouse Machine Co., gave interesting data as to the number of large engines at present in use in producing gas power and showed by lantern slides the arrangement of these engines in different plants and some of the particular features of construction. The paper can be satisfactorily reported only by the use of illustrations, which will be produced later if they can be secured.

Invitations from several cities were read for the holding of the next convention, some of which showed that the fact was not appreciated that the next meeting will be held in December. Racine, Wis., was

Fuel	Name of Engine	Rated Brake H.P.	Heat Converted into Work in cylinder %	Heat Lost in Jacket Water, Exhaust and Radiation %	Reference
Illum. Gas	Gueldner	20	42.7	57.3	Test by Schroeter Z. d. v. d. I. 1904
Nat. Gas	Walrath	75	27.1	72.9	Geer and Venelain Sib. Coll. Thesis. 1902
Prod. Gas	R. D. Wood	300	24.4	75.6	Goldsmith and Hartwig Sib. Coll. Thesis. 1905
Kerosene	Hornsby	25	21	79.	Robinson. 1908 Gas and Pet. Eng., P 710
Prod. Gas	Fair. Morss.	25	25.8	74.2	Jahnke Univ. Cin. Thesis. 1910

FIG. 1. DATA FROM TESTS OF GAS ENGINES SHOWING LOSSES

finally chosen as the place for the fall meeting, a decision which met with the approval of nearly all at the convention.

With his usual appreciation of fundamentals and emphatic desire to remedy defects, H. W. Jones took up the topic of "Some Things We Need in the Gas Engine Business." He argued strongly for the utilization of the waste heat from gas engines along some line similar to the method suggested by Prof. Faig and quoted cases of engines operating on producer gas where the exhaust heat was thrown away and the buildings heated with oil stoves, also water heated with a coal heater for washing various utensils. Another case where the exhaust piping from a gas engine was covered with asbestos and not 15 ft. away a coal stove was used to warm a room so that employes could work in it, while hot water from the engine jacket was thrown into the sewer and a steam boiler used to heat water for washing bottles; another instance where illuminating gas was used in enameling ovens at a large expense and electric motors for power purposes. Other instances were given of the throwing away of the valuable heat from the engine exhaust and paying out good money to get heat from a steam boiler or other source for uses which might just as well be served by the heat from the gas engine exhaust.

He asked also for some provision for properly placing a magneto on an engine and some method for properly driving it, also some way of installing wires for the ignition circuit and some definite way of locating the point of ignition with respect to the crank position, a graduated scale on the water supply valve so that the supply can readily be set at the point which is found to give best results, the removal of such causes of preignition as pockets in the cylinder, projecting points in the clearance and places where carbonized oil is likely to accumulate. Mr. Jones dwelt at length upon the need for educating the public to the realization of what gas power can accomplish, for overcoming the prejudice which has long existed against the gas engine

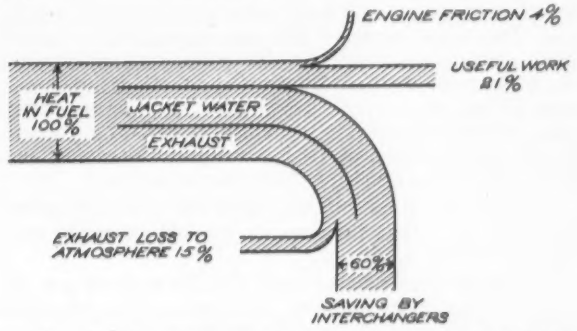


FIG. 2. DISTRIBUTION OF HEAT LOSSES IN GAS ENGINES AND POSSIBLE SAVING

because of its early misdemeanors and for literature which can be used in the education of power users by every available means.

"Gas engines now are standard, and that standard is high, and we gas engine men of today who desire to participate in the benefits of this high standard must see to it that this fact is made manifest to all men.

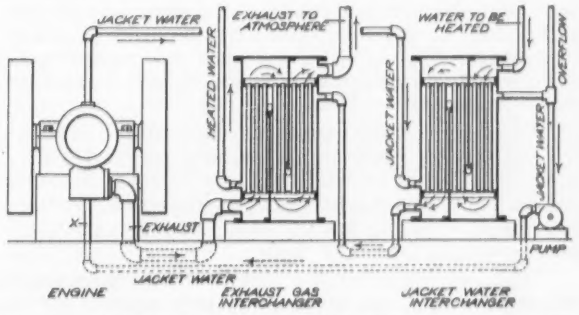


FIG. 3. METHOD OF SAVING HEAT FROM EXHAUST AND JACKET WATER

"We hear that 'gas engines are steam engines with a college education.' That is not true. Gas engines are self-contained power plants. We to furnish the education.

"What is this association for unless it be to furnish the education needed? And, unless I am very much misled by appearances of things, we need some few educational influences ourselves. It is all very well to stand here and laud our engines and ourselves to the skies, and then go to our factories and sales offices and expect returns. But that 'don't go' in this day and age.

" 'But for thee, my Bonnie Annie Laurie, I'd lay me down and dee.' This may have been all right in years agone, but anybody in the gas engine business who lays down and dees is a dead one. We find that we must be up and doing, and if we neglect to do those

things that the people want to see done, why, we might as well lay down and dee.

"Gas engines need—and the need is great. They need a man—one would be good, two would be better, if they were well posted, well equipped, enthusiastic gas engine men, to go to every gas men's meeting and speak before these gas men advocating gas power, instructing these men in engines that are! Not things that were. Bring into these conventions that thing which we all know is missing—confidence in gas engines among really well-posted gas men, but who are really densely ignorant of the gas engine of today.

"Gas men have not been educated up to our standard. We know that the proper compression is essential, and we know that a hot spark is essential, and we know that the timing of the spark is essential, and that oil and water in proper amounts is essential. Gas men all know this after a fashion, but they don't realize it, and if you speak to them about it they will say, 'Oh, yes, we know that.' But they don't do it.

"Then, we must educate them up to our standard, and see to it that they do as we advertise, or have educated them to do.

"You magneto men know that gas engines are not properly equipped for your machines. And yet, what have you done to educate the makers?

"It's all right enough to talk technical sometimes, but we want results, so why don't you see to it that there is a place provided for your goods? Now, on this point of ignition I was called to inspect a gas engine that would not pull its load. I found the igniter set so it ignited the charge at 20 degrees past center. I showed this to the proprietor, and he showed me the mark cut in the igniter mechanism that the installing engineer from the factory had cut, and had instructed this man to keep it right there, which he had religiously attended to, and the slippage of other parts added to the wear, made a differences of nearly 40 degrees. This is why we want the center mark cut out in flywheel and base where it can be seen and paid attention to.

"One of our best solicitors said to me that he wished he had some sort of reading matter to leave with his prospect so that they could post themselves on the many advantages of gas engines, and I did not have any. Oh, yes, it's my fault, but it's your business to see that we have them.

"The gas engine of the past, with its many undeveloped features, are no more to be compared to the graceful, smooth-running powerful machines of the present day, than is a tallow candle comparable to the gas arc lamp, or to an electric arc lamp, if it is made by gas power.

"Gentlemen, these needs should be attended to; they should be looked after; they are essential, not only to the user, nor to gas engines, but to us, ourselves and our families, and we owe it to our friends and customers.

"It is not asking more than is justly due when I ask you gentlemen to attend to these things. But if you won't do it, very well. But some day you will wake up to find that some live outfit has established a brand and has all of these valuable things attached on, and he will get rich and grow fat on the very provender that was ours once, but is no longer."

The discussion following this paper as to the advisability of appointing a committee to draw up specifications for standard gas engine equipment was followed by a motion to refer the whole matter to the executive committee, with power to appoint a special committee if deemed advisable.

The convention closed with appropriate resolutions expressing the appreciation of the courtesies extended by the manager of the hotel, the local committee and others who had aided to make the meeting a success.

What You Saw

IN the exhibit hall displays were furnished largely by the makers of apparatus auxiliary to gas engines rather than by gas engine builders. While the association is one of Gas and Gasoline Engine trades, the exhibit was distinctly one of auxiliaries and was an unfavorable comment on the interest which the engine builders of the association had taken in making the convention and the exhibit representative of engine practice.

To make more evident the points which were brought out by Dr. Acheson in his address, an impressive display was prepared of the Acheson Graphite products from the dry metal through the different grades of greases and oils, Gredag and Oildag, and showing what these new forms of lubricant have accomplished and can accomplish when used in gas engines and other machinery.

Batteries were the thing most in evidence at the exhibit, several makers showing large lines of their own as well as many applications in connection with spark coil exhibits.

Rock Island dry cells, shown by the Rock Island Battery Co., in different sizes, and sparker cells specially made for ignition, formed a pleasing exhibit and the literature showing the demand for such batteries, proper methods of connection, proper methods of use, was instructive. The Aldene, the S X, the Lutz and the Gordon cells are made by the Lutz-Lockwood Mfg. Co., the 2 last mentioned being primary wet cells for special purposes. "Red Top" and "Columbia" dry batteries of the National Carbon Co. were used on many pieces of apparatus. A convenient device for use in connection with batteries was the quick action one-piece battery connecter which is arranged either with copper hooks on the end of a strip or with copper strip having the ends formed into straight terminals for use with spring clips.

The Englewood Carbon Works, of Chicago, presented the X-cell battery, which was claimed to have 9 lives, and the Nungesser Electric Co. the Acme Rapid Fire battery.

Storage batteries and their uses were exemplified in the exhibits of the Electric Storage Battery Co. and the Geiszler Brothers Storage Battery Co. The electric storage exhibit showed a number of cells of different types for high and low voltage and the pamphlets explained the use of the storage battery for ignition cells in connection with gas engines and generators for residence lighting. The Geiszler batteries were represented by literature showing how to procure perfect ignition and electric lighting service for automobiles. Emphasis was laid on the nonsulphating feature of the battery.

Next in number came the magnetos for ignition work. These were both regular and unusual types; the S X magneto is made on the semi-high tension principle with transformer of 2 separate units, having 4 terminals for connections to the spark plugs, thus avoiding a high tension distributor. The Wizard tubular magneto for stationary and marine engines has the armature encased in a tube and imbedded in waterproof composition so that it is thoroughly protected from moisture. The Pittsfield magneto is made in 2

types, 1 the high-tension arc flame system in which the armature has 2 iron sections in a magnetic field and is so constructed that the retarded spark is just as efficient as the advanced spark. The second is the Dual System magneto in which there are no moving wires, both primary and secondary windings being placed in a water-proof housing at the back of the magneto. The Motsinger D. C. magneto is for make-and-break spark only and runs in neither direction. It is available for starting an engine without the use of battery and can be set horizontal, vertical or at any angle around the engine. The K-W magneto for low-tension work has the ability to operate electric lights and ignition circuits at the same time. It is made for either jump spark or make-and-break circuits, as desired. It gives sine waves of electric current rather than interrupted or zigzag waves. The Pfanstiehl Junior magneto is of the inductor type with no moving wires, with armature giving 4 impulses per revolution. The Mea high-tension or arc-light ignition system has bell-shaped magnets so arranged that the timing device moves with the magnet about the armature, thus giving the same strength of spark at all times.

Ignition coils and distributors for serving the ignition circuits of multicylinder engines were shown by a number of manufacturers. Primary spark coils by the Knoblock-Heideman Mfg. Co. were in 2 forms, the Long and the Quick Action Short form. "K-W" coils made especially for the K-W low-tension magneto are impregnated by a special vacuum process and are designed especially to give hot sparks. The Sterling coils are made up in sectional form and are carefully water-proof. Diagrams of proper connections for the Pittsfield systems were shown by the Pittsfield Spark Coil Co. Pfanstiehl coils, wound with flat sections carefully insulated from each other and having special vibrator, are part of the system, which includes magneto and a combination timer and distributor. The distribution is accomplished by a revolving head with a central brush terminal at which current enters, and terminals on the circumference corresponding to the cylinders in the motor. The Delco system is arranged to distribute the spark so exactly that an instantaneous spark is all that is needed after the engine is in operation. By special system of connection it has been possible to get such accurate and rapid action that a 6-cylinder 2-cycle engine running 1812 r. p. m. has been fired successfully.

Brass specialties were shown by D. T. Williams Valve Co., the Lunkenheimer Co. and Wm. Powell Co., including lines of goods suitable for use with gas and gasoline engines, such as grease cups, whistle equipment, generator valves, gasoline cocks, gasoline priming valves, sight feed manifolds and hand pumps.

Among the special exhibits was that of spark plugs, battery switches and terminals, by the Knoblock-Heideman Mfg. Co., Paragon oils and greases by the Paragon Refining Co., enamels and paints by the Mound City Paint & Color Co., the Winzeler gas and gasoline engine governor, the Endter friction clutch pulley, the Bauroth friction clutch pulley, the Minster friction clutch pulley, Roth Brothers' grinding and polishing machines, machinery for constructing gas engines by the American Tool Works Co., the Lodge & Shipley Machine Tool Co., and terminals and cables by the Holtzer-Cabot Electric Co.

No engines were exhibited, but literature was furnished by the Springfield Gas Engine Co., the Bauroth Gas & Gasoline Engine Co., the Myrick Machine Co., the Hagan Gas Engine & Mfg. Co., H. Bieder Mfg. Co., and the Tygard Engine Co.

LABOR IN EUROPE AND AMERICA

PEOPLE who are interested in the problems of organized labor will be sure to read the new book by Samuel Gompers called "Labor in Europe and America." Moreover, those whose interest in the subject is not personal will find much that is worth while in what Mr. Gompers has to say. He has produced not so much a dry discussion of conditions as a narrative of personal experiences and investigations written with freshness and vigor.

Humor is by no means lacking. For instance, it is said that in England it requires "3 requests of a waiter to get a glass of water and in Germany 5 orders and a fight." At the same time Mr. Gompers goes deeply into questions involving the state of labor in the various countries he has visited—England, Holland, Belgium, Germany, Switzerland, and Italy. Always he makes comparisons with things American. The great practical advantages to labor in America arising from a better school system, freedom from military burdens, and more liberal land policy are especially emphasized.

NEWS NOTES

THE MOUND TOOL & SCRAPER CO. has moved its shop and home office in St. Louis from 1606 North Broadway to the new plant at 7th & Hickory Sts, St. Louis, Mo.

LUCIUS I. WIGHTMAN, for the past 6 years advertising manager for the Ingersoll-Rand Co., 11 Broadway, New York, has resigned his position, the resignation taking effect August 1st. He will open an office in New York City as an independent specialist in machinery advertising, handling the accounts of manufacturers of machinery and engineering products. Mr. Wightman brings to his new enterprise qualifications peculiarly fitting him for this line of work. To his long experience in managing one of the largest advertising accounts and publicity departments in the machinery field, he joins a prior experience of years in practical mechanical and electrical engineering, construction work, machine design and manufacture, and machinery selling. His intimate knowledge of engineering in many phases will prove invaluable to those whose advertising accounts are placed in his charge.

THE HARRISBURG FOUNDRY & MACHINE WORKS has moved its Chicago office from 950 Marquette Building to 424 New York Life Building, where the business of the district will be carried on.

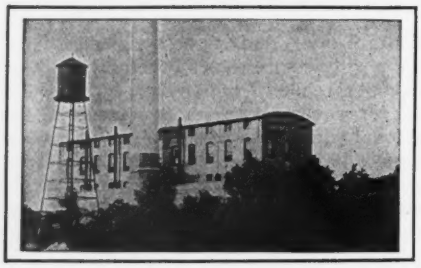
MR. JOSEPH H. DALTON, formerly Superintendent of Foundry of the Jeffries Mfg. Co., Columbus, Ohio, has recently accepted a position as superintendent of foundry for Geo. H. Thacher & Co., Albany, N. Y., who do a general business in grey iron and brass castings.

THE PAWLING & HARNISCHFEGFR CO., Milwaukee, Wis., designers and builders of Electric Cranes and Hoists, has recently appointed Albert B. Bowman, 720 N. Second St., St. Louis, Mo., as special sales representative.

THE WISCONSIN ENGINE CO., of Corliss, Wis., has recently established a branch office in the Fisher Building, Chicago, where George B. Foster will represent the company in the sale of its apparatus.

THE BOSTON OFFICE of the C. & G. Cooper Co. has been moved from 411 Weld Building to 201 Devonshire St., where the needs of those desiring steam engines will be looked after.

B. C. ALVORD, secretary and treasurer of the Shultz Belting Co., died on May 10 at St. Louis, Mo.



Power Apparatus

In Shop and Market

New Ideas in Making, Buying and Selling

THE WILLIAMS MOTION BOARDS

WITH some devices it is extremely difficult to explain or to show on paper their advantages, although these become immediately apparent as soon as the tools are seen in actual operation. So with the Vulcan-Bijaw pipe wrench the smooth action and the double wearing jaws can be fully appreciated only after seeing the wrench in use.

To show this wrench to advantage, therefore, the manufacturers, J. H. Williams & Co. of Brooklyn, N. Y., devised the motion board shown in Figs. 1 and 2. A model of the human arm was arranged as if gripping a wrench which in turn grips a short piece of pipe that is held with light friction in a Vulcan chain pipe vise. The arm with lifelike action moves the wrench which alternately grips and releases the pipe.

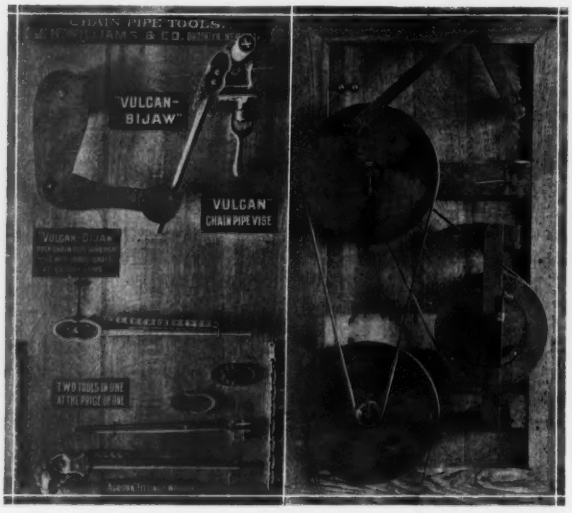


FIG. 1. MOTION OF THE ARM WITH BIJAW WRENCH
FIG. 2. DRIVING MECHANISM OF THE ARM AND WRENCH MODEL

Below is a wrench on which jaws are left free to revolve, and periodically they turn through 180 deg., illustrating the reversible feature. These jaws with straight cut teeth insure the distribution of pressure over the full surface, and the 2-bolt fastening enables quick repairs in case of accident, as one bolt provides full strength while the other prevents spread of jaws under excessive strain.

Motion for the parts is secured by a series of wheels and levers at the back, driven by belts from a ⅛-hp. motor.

On a second board, Figs. 3 and 4 the action of the Williams ratchet wrench is shown. One side of a drop forged wrench is cut away in peculiar form so that when turned in one direction it will grip a nut either square or hex., while, turned in the other direction, it slips around the nut without removing it. It thus works by a reciprocation motion, the same as a ratchet mechanism, but has no moving parts. Turning over the wrench makes it right or left hand.

On the upper part of the second board 2 wrenches are shown in operation, one on a square nut, the other on a hexagonal, and both as they would work in use. The rest of the board is used to display various forms of drop forgings, which is the special class of work done by the company. Fig. 4 shows the back of the board and the driving mechanism for the ratchet wrenches.

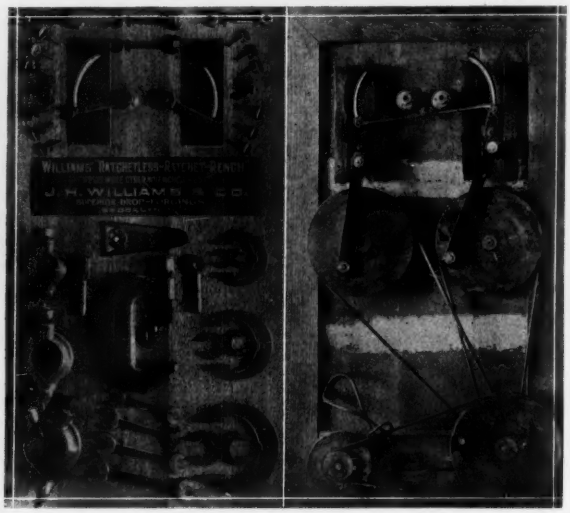


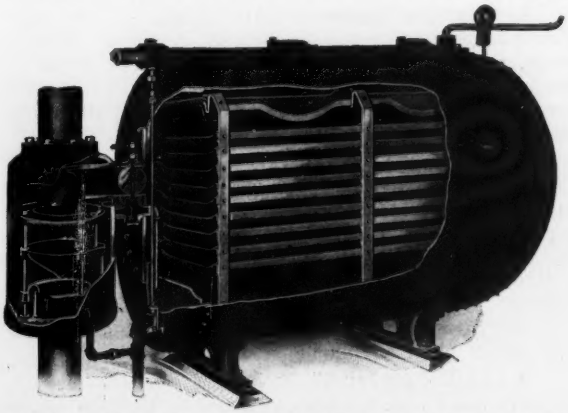
FIG. 3. DISPLAY OF THE WILLIAMS RATCHET WRENCH AND OTHER DROP FORGINGS
FIG. 4. DRIVING GEAR FOR THE RATCHETLESS RATCHET WRENCHES

"IT'S FAR MORE PROFITABLE to convince 10 readers that what you have to sell is the thing they should have, and make them come to you to buy, than to have 10,000 people see the name of your commodity and pass on without buying. The advertising writer who knows how to analyze his subject, arrange his points and describe them sufficiently must not be hampered if he is to make his readers do what he wants them to do." And that means take space enough to tell your story properly, in a paper that reaches the people who need your goods, and then—tell it. Not too many words but enough to drive home the good points of your machine and convince.

HOPPES IMPROVED INDUCTION CHAMBER

ONE of the most convenient and economical devices for use in power plant piping is shown in the accompanying illustration. This device is known as the Hoppes Induction Chamber and is designed to afford an easy and inexpensive means for piping up Hoppes feed-water heaters so that they can readily be cut out for cleaning, and when used in connection with a heating or drying system, that the surplus exhaust may be bypassed without using an independent oil eliminator and several large valves and fittings. The induction principle employed suggested the name. This apparatus, in slightly different form, has been manufactured and sold by the Hoppes Mfg. Co. of Springfield, Ohio, for a number of years and the large number in successful operation is the best proof of its merit.

It consists of a cylindrical shell or steam chamber which the steam enters from the bottom port, striking at once against a central cone which removes practically all



HOPPES INDUCTION CHAMBER FOR FEED-WATER HEATERS

of the oil particles carried in the current. Flowing upward, the steam is directed into the mouth of a downwardly curved pipe by a circular, trough-shaped plate with an opening at its center of approximately the same diameter as the pipe. This plate further serves to eliminate any oil which may not have been intercepted by impinging on the cone, and this oil is carried to the bottom of the chamber by the drain pipe shown.

To prevent the atomizing and spraying of the entrainment from the sides of the exhaust pipe entering the chamber, a trough is provided entirely surrounding this port, and a similar trough partly filled with water also guards the outlet to preclude all possibility of any slight entrainment creeping out. The exhaust steam entering the heater is at all times sufficient to heat the feed-water to 210 deg. F., and all oil is eliminated, not only from this steam, but also from the surplus steam passing to the heating system or atmosphere.

In order that the steam may freely enter the heater at all times, provision is made for carrying off the air and noncondensable gases through a small vent pipe and valve (shown in cut), the valve being operated on the same stem and simultaneously with the valve which controls the steam to the heater, thus permitting the cutting in or out of the heater by the turning of a single lever. The oil and moisture separated from the steam are carried off by the drain pipe on the side of the shell near the bottom, and this pipe being connected to the oil drain and over-flow pipe of the heater, the drainage from both is readily handled by one trap which is always furnished with Hoppes heaters, that are to be operated under back pressure.

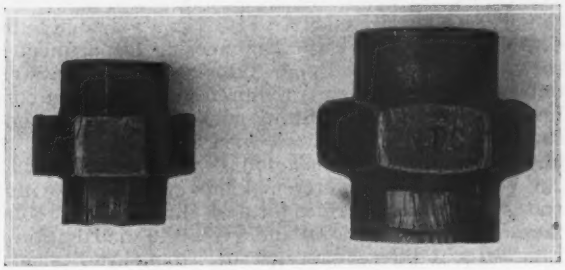
This apparatus for any size of exhaust pipe can be used in connecting up any size or type of Hoppes heater by means of an arrangement of interchangeable flanges. Some of the principal advantages claimed for this apparatus are that it affords a simple and convenient means for cutting out the heater for cleaning or inspection; it removes the oil and moisture from all of the exhaust steam, that going to heating system as well as to heater, thus eliminating the necessity of an independent oil eliminator in the pipe to the heating system; it takes the place of several large valves and fittings ordinarily required to connect up the heater so that the exhaust can be bypassed and the heater cut out for cleaning or inspection.

It will be noted also that this device embodies all of the essential features of the vertical oil eliminator for ascending currents, which makes it absolutely reliable in this respect, and the fact that the exhaust enters through a vertical pipe affords an additional recommendation, as it does away with a large elbow usually required to pipe the exhaust from a vertical line to the heater which must almost invariably be entered horizontally.

DURABILITY OF PIPE UNIONS

DURABILITY of a pipe union is a question of considerable interest to users.

A pipe union is only used where there is a probability of the joint being disconnected and reconnected at some future time; in other words, if the idea is simply to make a joint and there is no possibility of the joint being disconnected, a coupling will serve the purpose and be much cheaper than a union.



KEWANEE UNIONS AFTER UNDERGOING DISCONNECTION TEST

When, therefore, a union joint is used it argues the possibility of being disconnected and reconnected. In the case of an iron to iron joint, the question of corrosion was always involved which is eliminated in the case of a brass to iron joint.

The exact number of times that any pipe joint can be disconnected and reconnected depends upon the particular circumstances but a test recently made with Kewanee Unions may be of general interest to union users. The test was as follows:

"Delivered herewith are one 1-in. octagon Kewanee Union, one 1½-in. round Kewanee Union.

"These 2 unions were taken right from stock with no effort whatever at selection, and have been tested in the following manner. Each union was connected by means of a nipple, valve and nipple to a steam line. Into the other end of each union was screwed a nipple, on the outer end of which was another valve. The union connection was then tightened with an ordinary wrench, steam pressure was admitted by means of the

valve next to the main, the outer valve was opened to blow out the air and then closed.

"Close scrutiny was given the union to be sure that there was no leakage of steam. The steam pressure was then shut off, the outer valve opened to blow out the steam and the union ring was unscrewed entirely from the brass end.

"This operation was repeated over 1,000 times on each of the unions, and during the entire time neither union showed the slightest sign of a leakage of steam.

"After the completion of this test, each union was taken to the union department, and there subjected to the same test which is received by all new unions, that of 110-lb. air pressure under water. Each of these 2 unions was absolutely tight during this test, not the slightest bubble of air being shown when the union was submerged and subjected to the air pressure of 110 lb. per square inch."

The cuts herewith show these unions as made by the National Tube Co., after they had undergone the tests.

The point involved in this test is the fact that wherever a union is to be disconnected or reconnected an indefinite number of times, the gasketless type of union is preferable to the gasket type for in the latter case a gasket must be cut and fitted frequently involving not only delay (which means labor and money) but also the feature of an uncertain joint.

CATALOGS

KOMO STEAM TRAPS are made by the Linton Machine Co., of New York, and have a peculiar application of the expansion and contraction principle for draining separators and pipes of water. How the Komo operates is fully explained in a booklet which the Linton Machine Co. is issuing to those interested in steam plant operation.

DATA ON ILLUMINATION is a valuable bulletin, No. 73, issued by the Engineering Department of the National Electric Lamp Association. It shows not only what illumination is required in order to get comfortable reading and working conditions, but also how the lights should be placed with reference to the eye and to the work, and the amount of illumination which can be gotten from different kinds of lamps. It illustrates the proper schemes for desk illumination, rooms, factories, show windows and gives the distribution of light from different styles of lamps and shades. Formulas for rapid calculation of the illumination required, methods of spacing off lamps, and wiring tables for determining the sizes of wiring required are also included in the bulletin. It can be had by addressing the Engineering Department, National Electric Lamp Association, 4411 Hough Ave., Cleveland.

REGAL METALLIC PACKING is a special granular composition of the finest metal and graphite prepared for use in stuffing boxes of piston rods, valve rods and other reciprocating or rotating parts. Although originally granular in form it soon becomes a compact mass, giving a smooth metallic surface to press against the rod. It is illustrated and further described in an interesting folder received from the Regal Packing Co., 136 Liberty St., New York City.

LIFTING JACKS is the title of a new catalog issued by the Joyce-Cridland Co., of Dayton, Ohio. It gives dimensions, weight, price, etc., of the complete line of jacks made by this company.

BULLETINS RECENTLY ISSUED by the General Electric Co. are as follows:

High efficiency of the Mazda lamp makes it useful in the lighting of large areas, and in order to equip it so as to meet these conditions most effectively the Mazda Economy Diffuser has been designed. The special advantages of this diffuser are wide range of capacity, relatively low intrinsic brilliancy with excellent diffusion, and economical distribution of light. This diffuser is made in 2 principal types, known as the plain and ornamental. The plain type is designed for store and mill use, and the ornamental type for installations where the surroundings demand an elaborate design. Bulletin No. 4729 illustrates and describes the various designs of diffusers.

An attractive publication contains upward of fifty illustrations of installations of Curtis steam turbine-generators of various capacities. The number of this publication is 4732.

Bulletin No. 4742, entitled "Electric Drive in Grain Elevators and Flour Mills," describes in considerable detail the application of the induction motor to this work, and contains illustrations of a number of installations in various grain elevators and flour mills throughout the country.

The Multiple Luminous Arc Lamp is especially adapted for lighting machine shops, foundries, factory yards, and places where the slight fumes given off by the lamp are not objectionable. In Bulletin No. 4741 luminous arc lamps for multiple circuits are illustrated and described.

SPECIALTIES MADE BY THE Walworth Mfg. Co., of Boston, Mass., including Stilson wrenches, gage valves, pipe fittings, blowoff valves, quick closing water gage fittings, steam traps, steam fitters' and boiler makers' tools are listed in a convenient pocket catalog, which contains as well several pages of handy rules and information. This catalog is furnished by the Walworth Mfg. Co., and the supplies listed in it are to be obtained from any power plant supply house.

"A STUDY IN HEAT TRANSMISSION," by J. K. Clement and C. M. Garland, is issued as Bulletin No. 40 of the Engineering Experiment Station of the University of Illinois. The bulletin describes a method of studying the effect of the agitation of a medium in contact with metal walls upon the heat conducted through these walls and to or from the medium. Results of experiments upon the heat transmitted to water as the medium in contact with the walls of a tube, under varying velocities or rates of agitation, are given. Copies of Bulletin No. 40 may be obtained gratis on application to W. F. M. Goss, University of Illinois, Urbana, Ill.

BRISTOL CLASS I Self-Contained Recording Thermometers are made for recording any series of temperatures, atmospheric refrigeration and dry room, and run from 10 degrees below zero up to 150 degrees. They continuously record the temperature at the point where the instrument is installed, as in a cold storage room, in a dry kiln or other place where the temperature must be kept within certain limits. Full description with illustrations of the different types and of the different scales of charts furnished are shown in Bulletin No. 125, one of the attractive series issued by the Bristol Co., of Waterbury, Conn.

THE JUNE ISSUE of Sawyer Belting Booster contains, besides a list of canvas stitched roll belting and endless belt in stock, a number of curt paragraphs comparing hard times and prosperity.

THE MARINE BOILER WORKS CO., of Toledo, Ohio, has just issued a catalog describing and illustrating the boilers manufactured by this company and also showing the excellent facilities which it has for turning out high grade marine and stationary boilers.

BULLETIN NO. 4022 of the Allis-Chalmers Co., entitled Lighting Transformers, calls attention to some of the distinctive features embodied in the design. These transformers are built substantially to stand the strains ordinarily met. The small sizes are of cast iron, while the larger are built with corrugated steel cases. All transformers are guaranteed to carry ordinary overload not exceeding 25 per cent for 2 hr. They are tested at 150 per cent load for 20 min., so that temporary excessive loads will not injure them. Copies of this bulletin may be had on application to the company.

CATALOG NO. 27 of the Ohio Injector Co., as it makes its appearance, creates a most favorable impression, which is enhanced as one looks through the catalog. This is well planned, full of interesting matter in regard to injector action and details and gives complete description of the different styles of injector made by the company, with capacities and price-lists for the complete instrument and for the separate parts. The catalog describes besides injectors and ejectors of all styles, lubricators with single and double connection, strainers, gage glasses and fittings, grease cups, gages, globe, angle and swing check valves, and gage cocks.

THE CARB-OX CO., of Chicago, has just published a catalog describing Hays gas instruments which are used for analyzing flue gases. The book is very interesting to those trying to bring up the efficiency of their plants, as it not only describes and illustrates the instruments employed, but tells how they are used and how to secure best results.

TRADE NOTES

THE ROLLINS STEAM SPECIALTY CO., of Chicago, the Eckert Plumbing & Heating Co., of Seattle, and the Biggs Heating Co., of Washington, D. C., have recently been purchasing a number of Swartwout Separators and Exhaust Heads made by the Ohio Blower Co., of Cleveland, Ohio.

THE ANNISTON IRON CORPORATION, of Anniston, Ala., which is building an extensive plant, has just placed an order with Allis-Chalmers Co. for 2 blowing engines. These are of the long cross head type with cylinders 44 and 84 by 60 in.

TAYLOR GRAVITY UNDERFEED STOKERS manufactured by the American Ship Windless Co., Providence, R. I., are to be installed by the following for the specified boiler horse powers: Lowell Electric Light Corp., Lowell, Mass., 1 7-retort stoker for a 600 hp. B. & W. boiler; Metropolitan Street Railway, New York, 2 3-retort stokers for 250 hp. B. & W. boilers; City of Grand Forks, N. D., 1 3-retort stoker for a 250 hp. Freeman boiler; Dallas Electric Light & Power Co., Dallas, Texas, 2 7-retort stokers for 500 hp. B. & W. boilers; Detroit Public Lighting Commission, Detroit, Mich., 2 4-retort stokers for 400 hp. Stirling boilers; Lake City Power & Light Commission, Lake City, Minn., 1 3-retort stoker for 250 hp. Stirling boiler; and through their New York agents, the Lenher Engineering Co., 2 2-retort stokers for heating furnaces at the Solvay Process Co., Detroit, Mich.

THE VAUGHAN & BUSHNELL CO., of Chicago, is increasing the capacity of its hardware plant and has recently placed an order with Allis-Chalmers Co. for a 16 by 36 in. heavy-duty Corliss engine to run at 100 r.p.m. This will be fitted with a rope fly wheel for driving the shafting in the shop.

THE SPEED CHANGING DEVICE which has heretofore been known as the Lincoln variable speed motor will in future be known as the Reliance Adjustable Speed Motor in order to better describe the type and to avoid confusion with other apparatus. It will, as heretofore, be made by the Reliance Electric & Engineering Co., of Cleveland, Ohio.

THAT THERE is a big demand for an automatic water gage glass that is absolutely safe in case of breakage of the glass is indicated by the rapidly increasing demand for the Swartwout automatic quick-closing gage glass made by the Ohio Blower Co. This type of gage glass has recently been furnished M. L. Kline, Portland, Ore.; Old Town Woolen Co., Old Town, Me.; W. T. Magruder, M. E., Ohio State University, Columbus, Ohio; Borden Condensed Milk Co., Newport, Me.; Bates Mfg. Co., Lewiston, Me.; The Alkali Rubber Co., Akron, Ohio; York Mfg. Co., Saco, Me.

THE AMERICAN SHIP WINDLASS CO., Providence, R. I., manufacturers of the Taylor Gravity Underfeed Stoker, report the following orders: 3 stokers for the Cambria Steel Co.; 6 stokers to be used with 6 600-hp. Stirling boilers at the Worcester Electric Light Co.; 4 stokers to be applied to 4 1250-hp. Hornsby boilers at the Hartford Electric Light Co.; and 1 stoker for the Lackawanna Steel Co.'s plant at Lackawanna, N. Y.

THE AMERICAN STEAM PUMP CO. received a letter from the chief engineer of the Central City Laundry Co., Selma, Ala., which illustrates the durability of the Marsh pump. The following is quoted from the letter:

"I want to say a few words in regard to the Marsh pump and don't want you to think I have an ax to grind. I am a practical machinist with 23 years' experience and have handled all or practically all kinds of pumps, but the Marsh beats them all. On the pump I am using this is the first 5 cents I have ever spent for repairs and it has been going steady 10 hours per day, 6 days per week, for nearly 9 years."

FOLLANSBEE BROTHERS COMPANY, of Follansbee, W. Va., is now making arrangements to greatly increase the capacity of its steel mill. Electric drive will play an important feature in the changes that are being made and to supply the necessary power an order has been placed with Allis-Chalmers Co. for a low pressure turbine. This will be a 1500-k.w., 2300-volt, 3-phase, 25-cycle machine running at 1500 r.p.m. with an exciter coupled to an extension of the shaft. Steam for this unit will be supplied from the exhaust of the present engines.

RECENT SALES MADE by the York Mfg. Co. are as follows: Atlanta Coco-Cola Bottling Co., Atlanta, Ga., 1 6-ton refrigerating plant; Henry I. Beers, Jr., Dover, Del., 1 20-ton compression side and additions to freezing and distilling system; S. S. Brown & Co., New York, N. Y., 1 8-ton refrigerating plant; Harris & Wright, Tiptonville, Tenn., 1 20-ton compression side and 6-ton freezing and distilling system; H. S. Davis, Covendish, Vt., 1 8-ton refrigerating plant; Bavarian Brewing Company, Covington, Ky., 1 175-ton refrigerating machine; Sherman Hotel Co., Chicago, Ill., 75-ton absorption plant, 10-ton freezing and distilling system and piping for refrigerator boxes; Boerne Dairy Feed Co., Boerne, Texas, 1 8-ton refrigerating plant; Southern Fruit Co., Charleston, S. C., 1 8-ton refrigerating plant; Treasure Hill Ice Co., San Antonio, Texas, 1 10-ton ice plant; A. H. Farley, Salt Lake City, Utah, 1 4-ton refrigerating plant; Ocean City Ice & Coal Co., Ocean City, Md., 1 15-ton ice making plant; Cash Coal Co., Woods Hole, Mass., 1 15-ton plate ice plant driven by Westinghouse Machine Co., gas producer and engine; Aransas Ice & Cold Storage Co., Aransas Pass, Texas, 1 25-ton ice plant; Kent Co., Limited, Montreal, Canada, 1 20-ton refrigerating plant; National Tube Co., McKeesport, Pa., 1 10-ton refrigerating plant for cooling drinking water; Florida East Coast Ice Co., Miami, Fla., 1 35-ton ice making plant; Standard Waygood, Ltd., Syd-

ney, New South Wales, 2 35-ton refrigerating machines and plant; Jacobs Candy Co., New Orelans, La., 1 6-ton refrigerating plant.

LYONS BOILER WORKS report the sale of a 325-hp. boiler to The Morgan Co. of Oshkosh, Wis., also one of the same rating to The Buckstaff Edwards Co., of the same city.

GOOD BUSINESS has been the lot of Walter L. Flower Co. during 1910 as is shown by the fact that from the first of February to May 18 Acme Oil Filters have been sold as follows:

Feb. 3, 8 to the Vacuum Oil Co., Rochester, N. Y., for export to Japan; Feb. 4, 1 to the Standard Oil Cloth Co., New York, for export; Feb. 7, 1 to the Vacuum Oil Co., of Boston; Feb. 16, 1 to the Equitable Powder Co., E. Alton, Ill.; Feb. 21, 4 to the Vacuum Oil Co., of Rochester, for export to Japan and 1 to the same company for export to China. Also 3 to the Eubank Machinery Co., Dallas, Tex.; Feb. 23, 12 to the Vacuum Oil Co., for export to Japan; Feb. 28, 1 to the Leavitt Land & Lumber Co., Dermott, Ark., and 1 to Paul B. Huyette Co., of Philadelphia; Feb. 26, 3 to the Valvoline Oil Co., of Los Angeles, Cal.; Mar. 2, 1 to E. M. Schwarz & Co., New York, N. Y.; Mar. 5, 1 to the Rock Island Stove Co., Rock Island, Ill.; Mar. 9, 2 to the Fairbanks Co., of New Orleans; Mar. 10, 1 to Williams & Wilson, Montreal, Canada; Mar. 15, 1 to the S. M. Price Machine Co., Norfolk, Va., and another on Mar. 25; Mar. 26, 3 to the Valvoline Oil Co., of Los Angeles; Apr. 11, 1 to Xavier A. Kramer, Magnolia, Miss.; Apr. 14, 1 to the Johnston City Electric, Gas & Water Co., Johnston City, Ill.; Apr. 16, 1 to Paul B. Huyette Co., 1 to St. Louis Dressed Beef & Provision Co., St. Louis, Mo.; April 20, 12 to Vacuum Oil Co. for export to Japan; Apr. 22, 3 to Markt & Schaefer Co., New York, for export; Apr. 29, 1 to the Wm. T. Johnston Co., of Cincinnati, O., also 1 on May 2, 2 on May 6, and 1 May 7; May 5, 1 to Heim Brewery, East St. Louis, Ill.; May 11, 1 to the Standard Collieries Co., Johnston City, Ill., and another to the Johnston City Coal Co.; May 13, 1 to Sunderland Machinery & Supply Co., Omaha, Neb., and 1 to the South Bend Supply Co., South Bend, Ind.; May 14, 1 to Wm. R. Winn, Springfield, Mass.; May 16, 1 to Greenwood Mfg. & Supply Co., Boston, Mass.; May 18, 1 to the St. Anthony's Hospital, St. Louis, Mo., and 17 to the Vacuum Oil Co. for export to Japan.

ELECTRICAL LUMBERING is becoming common, in spite of its seeming improbability. The Three States Lumber Co., of Burdette, Ark., is now changing more of its machinery to electric drive and in addition to the electrical machinery bought of Allis-Chalmers Co. some time ago, has just placed an order with the same company for additional equipment. This will include the following: A 175-kw., 440-volt, 3-phase, 60-cycle, 600-r. p. m. generator, a 9-kw. exciter, one 50-hp. and one 20-hp. squirrel cage induction motor and a switchboard.

PRACTICAL ENGINEER CLASSIFIED ADVERTISEMENTS

Advertisements in this section are inserted under regular headings at the rates of 40 cents per line. About nine words make a line. No display type is allowed, but the first three words may be set in capital letters. Minimum space sold, two lines.

Under classification, "Positions Wanted," advertisements not exceeding four lines will be inserted for subscribers once free of charge.

To insure proper classification, copy must reach this office on or before the 15th of month preceding publication.

Positions Wanted

POSITION WANTED as traction or small stationary engineer, 29 years of age and experienced with both. Address G. G. Lewis, R. F. D. 2, Box 27, Warrensburg, Ill. 6-2

POSITION WANTED as assistant engineer, oiler, dynamo tender or operator's helper in electric light and power plant. Age 21; best of references given; strictly sober and reliable. Has had a little experience. Paul C. Schwemm, 862 N. Ashland Ave., Chicago, Ill. 7-1

CHIEF ENGINEER desires change of position, technical education, with large experience in power plant work. Wants position with concern where hard work and ability count. Either large manufacturing plant or electric railway preferred. Address Box 134, Practical Engineer. 6-2

Help Wanted

A LARGE ELECTRICAL CONCERN has vacancy for a superintendent of their plant. Product is both light and heavy; about half of output consists of ammonia compressors. Applicant must have good executive ability, be able to combine aggressiveness with diplomacy and must assume charge of entire work. A permanent position is assured to the right man. Address Box 135, Practical Engineer. 6-2

AGENTS WANTED to sell Burgmann celebrated engine packings in territories not yet covered. See our advertisement on page 18 of this issue.

WANTED—AN ENGINEER in each town to sell the best metallic packing for steam, air, gas and ammonia. Write Ideal Metallic Packing Co., South Stillwater, Minn. 5-tf

ENGINEERS AND MECHANICS—To make big money selling Incomparable "ZIZ" Hand Soap. A 10-cent can will instantly remove more dirt and stains from the hands than four cakes of any soap made, and it will not injure the most delicate skin. Small sample free. Byram Mfg. Co., Box 3133 Boston, Mass. 4-tf

WANTED—Established and experienced engineering specialty salesman to sell, on commission basis, to power plants and jobbers in exclusive territory, the most widely advertised specialty of its kind; used by every power plant in the country. We have a particularly attractive proposition. State experience. George M. Newhall Engineering Co., Philadelphia, Pa. 4-4

For Sale

FOR SALE—Engines, cheap; Frick 75 H. P. Corliss steam, $400; Swan 25 H. P. gasoline or gas engine, only $250. Address Gerald Overbay, Hamilton, Ohio. 7-1

Patents and Patent Attorneys

FREE BOOKLET—All about patents and their cost. Shepherd & Campbell, Patent Attorneys, 500 M. Victor Bldg., Washington, D. C. 5-tf

DIETERICH'S 50 PERPETUAL MOTIONS—100 mechanical movements; books tell about perpetual motion and how to obtain patents; by mail for 25 cents, postage or coin. F. Dieterich & Co., Patent Lawyers, 64 Oray Block, Washington, D. C. 4-tf

PATENTS—C. L. Parker, late Examiner U. S. Patent Office, Attorney-at-Law and Solicitor of Patents. Patents secured promptly and with special regard to the legal protection of the invention. Handbook for inventors sent upon request. 186 McGill Building, Washington, D. C. 4-tf

Miscellaneous

DRY BATTERIES EXHAUSTED can be renewed for 2 cents each. Simple, scientific instructions 25 cents. Dirigo Sales Co., Bath, Maine. 7-3

GREASE, OIL AND LUBRICATE your loose pulleys and shafting with graphite, mica or asbestos candles; no drip; no dirt; economical. Swain Lubricator Company, 250 Lake St., Chicago. 5-6

EVERY ENGINEER should know about the new system of Vacuum Heating which can be installed without payment of royalty. Particulars will be cheerfully furnished. T. L. Reeder, 1413 W. Jackson Blvd., Chicago.